THE

Practical Teacher

A MONTHLY EDUCATIONAL JOURNAL

Edited by JOSEPH HUGHES.

'Knowledge is proud that he has learned so much,
Wisdom is humble that he knows no more.'—COWPER.

VOL. IV. No. 7. SEPTEMBER, 1884. PRICE 6D. POST FREE, 7½D.

Hygiene.

BY ALFRED CARPENTER, M.D., M.R.C.P. (LOND.),
Chairman of the Council of the Sanitary Institute.

TEA AND COFFEE, AND SIMILAR BEVERAGES.

THAT infusions of vegetable substances fill an important position, as articles of food, in the economy of nature cannot be doubted; they have been used in some form or other from time immemorial. Infusions of bitter herbs are occasionally mentioned in the older writers, as diet drinks. We read that Esau sold his birthright for a mess of pottage. Jacob sod (seethed) pottage, and Esau, being faint, desired it. Whether this was some form of tea, or, which is more probable, some alcoholic drink made from lentils, a farinaceous fruit, is uncertain; I incline to the view that it was alcoholic. There is no doubt as to the bitter waters in the wilderness at Marah. These were sweetened by infusing the leaves of some shrub growing in the neighbourhood, and a kind of tea produced, by means of which the Israelites assuaged their thirst. This use of vegetables for correcting the badness of a water supply, therefore, is very ancient, and in the case of the Israelites deservedly ranked as a miracle; and whilst such infusions are grateful in themselves, we also have the agreeable feeling that they give us the best means of purifying an unwholesome water, and save us from its fatal consequences. Tea and its congeners are, therefore, great sanitary aids. It provides for us 'the cups that cheer, but not inebriate' (Cowper). The usual dietetic infusions and decoctions have active principles, which go by the name of Theine, Caffeine, Cocoine, Guaranine, Theobromine, etc. These principles are alkaline in their nature, and are identical in their effects, both chemically and physiologically; in large doses they produce convulsions, tetanus, paralysis, etc. It is said that their universal use must indicate a universal want in our natural constitution, and that they serve some physiological condition which men of science have not yet been able to point out; but the same has been said of intoxicating beverages; these, however, are thoroughly non-intoxicants. It is singular that those most-generally in use are taken from allied classes of vegetables, but they are not restricted to one or two classes, for an immense number of dried leaves and prepared [illegible] and roots, taken from all divisions in the vegetable kingdom, have been used for similar purposes. The popular infusions are very much alike; they contain volatile oil and astringent matter, with some so-called alkaloid which is crystallizable and is rich in nitrogen. It is possible, as has been pointed out by Liebig, that they may assist in the production of bile. They are closely related in their composition to nerve tissue, and seem to be of service in repairing exhausted brain-matter. They act to some extent in the same direction as alcohol—that is, in retarding the waste of tissue; they seem to enable food to go further than it otherwise would, so that men can, by the aid of tea or coffee, do more work with less exhaustion than with any other kind of ordinary liquid food. It is found that there is a difference also in the result as to the excretion of CO_2, for whilst alcohol diminishes the formation of this debris, both tea and coffee increase the quantity excreted to a slight degree. It has been likened to the action of oil upon delicate machinery, lubricating the animal system, and so enabling it to work rather easier. The late Dr. E. Smith has pointed out that there is a greater depth and more freedom in respiration under their influences, and that the transformation of starchy and fatty food is promoted. But whilst tea induces perspiration and lessens the heat of the body, coffee dries the skin and acts upon the mucous membrane of the bowels. Each, therefore, is suited for different times and different constitutions. Cocoa differs from tea and coffee in containing a large amount of fatty and albuminous matter, and is therefore a more decided food, and has a high nutritive power. It is not so easily digested by a delicate stomach.

There are fictitious teas, coffees, and cocoas, which have none of the true advantages which belong to the real articles. The earth-nut, the chestnut, and the chicory root, do not possess the alkaloid, and have not therefore any of the distinctive properties which belong to the more specific form of diet drinks, and cannot be properly substituted for them; whilst infusions of other herbs are none of them so exhilarating and refreshing as ever to be likely to replace tea and coffee in the estimation of mankind.

AIR: ITS HYGIENIC PROPERTIES.

AIR consists of O 20·9, N 78·4, CO_2 ·04, aqueous vapours ·86, in 100 parts. There are sometimes also

traces of NH_3, N_2O_5, CH_4, and SO_2, and Ozone; the aqueous vapour is, however, very variable. The impurities consist of increase in the quantity of CO_2, in the more decided presence of SO_2 and NH_3, with SH_2 and floating carbon, oily and organic particles of various kinds, the products of smoking chimneys. The oxygen is diminished by all those agencies which lead to oxidation, such as the respiration of animals and consumption of carbon by fires, etc., the oxidation of metals, and decomposition of all organic matters. It is, however, a curious point, that the open air in the worst districts of London and the densest parts of all large cities scarcely varies more than 700 parts in a million in the worst situation as compared with the best; whilst if the air be taken from the pit of a crowded and ill-ventilated theatre when at its worst, there is a loss of not more than 3000 parts in the million as compared with that in the open country. If the quantity of oxygen is diminished from 20·9 to 18·5 per cent. a candle cannot burn in it, and, of course, animal life would soon also cease. A loss which equals three parts in a 1000 (3000 in a million) does not appear to be much, but it has a wonderful effect upon the animal world; we have, therefore, to consider the presence or absence of very minute quantities. Dr. Angus Smith has shown this very clearly in his wonderful work on 'Air and Rain,' which should be consulted by all who are observers in this direction. It is probable that the absence of O (being always accompanied by the presence of some other and unnecessary gas) may not be the real factor in the effects produced, but that it is the introduction of the impurity which has been formed at the expense of the O which has been lost. CO_2 is always present in the air. It is found in the open country, on mountain-tops, and in deep valleys, upon the broad Atlantic, and in the caverns of the earth. Its average is about 4 parts in 10,000. It is largely increased in crowded towns, in ill-ventilated apartments, wherever life abounds and oxidation is in action. The rapid diffusive power which belongs to all gases is very manifest in the case of CO_2, for it is seldom found to exceed ·1 per cent. in the open, in the most densely populated towns. Dr. Angus Smith says there is no difference even in the second decimal place as to the normal in country places, and he considers ·0336 per cent. (which is less than 4 parts in 10,000) in uncontaminated places as a good average. The senses are able to appreciate a difference which is exceedingly minute. This may be observed in any crowded town as compared with some open space in close proximity, and in which the excess is probably less than two parts in 10,000. The ground air of a given place is sometimes much more impure as oxidation is progressing, in consequence of the decay of organic life. CO_2 abounds; it is always excessive in such cases, rising, sometimes, to three or four per cent. There is an antagonism as regards the production of CO_2 between animal and vegetable life; all animals produce it in consequence of the act of living; all vegetables live upon it and return oxygen separated from the carbon back into the atmosphere. There are exceptions in the case of fungi, which give out CO_2, and some forms of animalcular life, which set oxygen free; but the rule is as stated; the one kingdom counteracts the depreciating power of the other. There is a doubt in the minds of some sanitarians as to the injurious effect of excess of CO_2. They refer to the fact that it may be breathed in much larger quantities than normally exist in the atmosphere, without injurious effects, provided the O is undiminished and organic impurities do not abound. It is supposed that there are more dangerous effects from the ammonia compounds and other impurities which are given off by the breath, and which rapidly putrify, and that these are the materials which give rise to danger in densely-peopled districts and over-crowded habitations; that we must look to these gases, and the minute organisms which accompany their production, for the causes of mischief, and not merely to the presence of CO_2 in excess. It is probable that the truth lies in a combination of both, and that small quantities of the ammonia compounds would be comparatively harmless if CO_2 was not in excess and if O was at its normal amount.

Nitrogen.—This part of the atmosphere appears to be negative in its qualities, and as if it existed for the purpose of diluting the oxygen, which in its pure form cannot be breathed for many minutes with impunity. It forms four-fifths of the bulk of the air. It is very inert, and animals die if kept in N simply from the absence of O; and yet in its nascent form it has tremendous power. Its deficiency or excess is of no moment in its usual state, and it need not be further considered, except in connection with its alliance with hydrogen, by which ammonia is evolved.

Ammonia, NH_3.—This gas is always present in the neighbourhood of large towns, either in its simple or in its combined forms. It is always found in the rain which is collected in inhabited districts, but it is the first part of a shower which contains the largest part of ammonia. The rain washes it out of the atmosphere, and sends it into the earth as food for the vegetable world; it combines with sulphurous and nitrous acids, forming ammoniacal salts, which are decomposed if the water is evaporated to dryness, and the acids then combine with the lime or soda salts, etc., which also frequently find access to deposits of rain water. The quantity is extremely minute; it is increased in foggy weather, especially in those fogs which are associated with smoke produced by the consumption of coal. Dr. Angus Smith has calculated the average to be about $\frac{3}{4}$ of a milligramme per litre, and he states on the authority of M. Bineau, that the quantities of ammonia furnished by the rain in each year would be equal to about $\frac{1}{4}$ of that which was afforded by an ordinary manure dressing, but there is a great difference in different districts according to the populous state of the country in which the specimen has been collected. Dr. A. Smith's conclusions are, that ammoniacal salts increase in the rains as towns increase, that they come partly from coal and partly from decomposed albumenoid substances, and may be taken as measures of population.

Nitric Acid, N_2O_5.—When the O of the air acts on the NH_3, or the organic substances containing N, it forms nitric acid. Within certain limits it increases in quantity in the higher regions of the air, and it increases as the quantity of ammonia diminishes. It is more evident in a continental or an inland town than on the sea-coast, and its presence in the air of the British Isles is very much interfered with by the presence of SO_2, which our fuel provides; it is more abundant in the rain which descends at the first onset of a thunderstorm, and it is also probably formed by the passage of electric currents through the air.

Sulphurous and *Sulphuric Acids* (H_2SO_3, *and* H_2SO_4).—The decomposition of protein compounds give rise to the formation of SH_2 and $(NH_4)_2S$, which become oxidised. Sulphates are formed, and they become harmless as regards health. They increase over the land, because of vegetable and animal decomposition; they are in greatest quantities near the ground. The sulphur in the atmosphere is the index of the amount of vegetable and animal decomposition. The sulphur oxides increase in towns in a double ratio, because of the decay of vegetable and animal matter, and to a much greater extent from the wasteful combustion of coal which now goes on. Combustion, when it occurs in an ordinary grate, gives out sulphurous acid, which soon changes into H_2SO_4. Its action is seen upon all the public buildings of London. Westminster Abbey is crumbling from its effects, and all our national monuments suffer from the way in which our atmosphere is polluted by smoking chimneys and the discharge of oxides of sulphur. Its effect is also seen upon the brass door-plates of all large towns. The rain collected in large towns is always more or less acid, according to the quantity of coal consumed. The presence of H_2SO_4 will be, therefore, to some extent, a measure of density of population.

Chlorides of Sodium, etc.—The chlorides are found in the neighbourhood of the sea; they diminish as we leave the coast; but they increase again in large towns, but then the amount of chloride does not rise so high as when a wind blows the air from the sea-coast towards the point selected for observation. This is seen in London. There is an increased amount also in the neighbourhood of alkali works and manufactories which decompose salt, such as is the case in the potteries. These give off hydrochloric acid, and at times produce a most stifling sensation to those breathing it; especially is this so in the neighbourhood of the potteries in Lambeth, which continue to pollute the atmosphere of London to a very serious extent.

(*To be continued.*)

—o—

Friedrich Fröbel.

BY HIS PUPIL, HEINRICH HOFFMAN.

X.—(*continued.*)

FROBEL'S beloved wife began to exhibit symptoms of declining health. She was no longer equal to her arduous duties, and her medical attendant said that this was chiefly due to the climate, which was decidedly unfavourable to her. The sudden loss of her mother, with whom she had always been one in mind and affection, increased her sufferings to an alarming degree, and a speedy change became an imperative necessity.

Fröbel, therefore, resigned his office. Langethal, who remained, was afterwards joined by Ferdinand Fröbel, who, by the breaking up of the Willisau undertaking, was happily open to another engagement.

Family affairs called Fröbel and his wife to Berlin (April, 1836); but he continued to devote himself energetically to the new idea. Its games and plays were to be the principal means of developing the faculties of young children. They had to be spiritualised and shaped into a regular and rational system. Gradually the idea matured in his mind to establish an institution for the culture of early childhood. Barop obtained for him suitable premises in Blankenburg, a small town on the Schwarza, not far from Rudolstadt, renowned for its salubrity and for its beautiful scenery. Quietly, and without any ostentation, the experiment was begun in 1837. For a while it was but an experiment; much was to be learned from experience: deep studies had yet to be made, but the schoolmaster was a thing of the past, and both husband and wife worked together incessantly. They both were, for the time, pupils of the little children, whose lessons never fell on stony ground. Literary labours engaged Fröbel in his spare hours, and in December, 1837, there was issued a weekly paper entitled, *Das Sonntagsblatt*, with illustrative plates, containing the general outlines of the new enterprise. The institute itself was designated, 'The Institute for the culture of Family Life, by the cultivation of the industrial and inquiring propensities of the Child.'

To the student of the Kinder-garten this publication is as instructive as it is interesting, the various occupations of the children, and especially the first five gifts, being minutely described. Owing to Fröbel's unfortunate policy of publishing on his own account, however, his work found but few readers, and the expenses of publication were barely met. It is not very likely that Fröbel would have persisted in a course so unwise had there been no difficulty in finding a publisher. The propagation of the new system, as well as the careful training of teachers, engaged his earnest attention. Lectures were delivered in many places, near and far; teachers came from different institutions to become initiated; and already, before his inner vision, there arose a seminary, the first and indispensable step to whose real existence was the practical sympathy of thoughtful and influential men.

Among his coadjutors, Frankenberg proved an invaluable and most zealous apostle. He travelled about from place to place, carrying copies of the 'gifts' in his carpet bag. In Leipsig and Dresden he met with much success. Krause, the philosopher, and Dr. Herrmann von Leonardi had been, since 1828, among Fröbel's warmest friends and supporters. The former has exercised a great influence on him, and his philosophy found an enthusiastic admirer in Friedrich Fröbel. The latter was very active in propagating the new plans, and inducing teachers to study them in Blankenburg itself. Public opinion soon eulogised, in high terms, Fröbel's labours among the infants, some forty or fifty of whom were daily gathered round him. Visitors of high social position were not rare. The hereditary Grand Duchess of Mecklenburg-Schwerin was so delighted with her visit that she said, 'I should like to be here every day.' It became quite a fashion with tourists, to pay a visit to the infant school at Blankenburg, as one of the sights of Thuringia.

In the spring of 1839, Fröbel, Middendorff, and Frankenberg, went to Dresden, where the Queen and most persons of rank and influence listened attentively to an able address on the new system. It was a complete success. The Queen, after half an hour's conversation with Fröbel, expressed her entire approval, and said, 'These aspirations of yours are very beautiful and very noble.' The result was, that a *play-school*, as it was then called, was established at the 'Brühlsche Terrasse,' under the management of Adolph Frankenberg. Meanwhile, the bright star,

that had so beautifully illuminated Fröbel's path, was fast setting; his dear wife declined from hour to hour. Happy and contented that her husband had at last arrived at his true destination, she was most anxious to conceal from him the real state of her health, lest it might check his ardent zeal. So she still wrote most cheerful letters to Dresden, full of encouragement and good hope. So much the heavier must her loss have fallen on him when, on the 13th of May, 1839, in her fifty-ninth year, she was called to her heavenly home. Honour to her memory! In all his troubles she had been the mainstay of his life, the noble genius that upheld him, and that bore her own troubles with such heroic fortitude as belongs only to a woman of so exalted a character. To her is principally due the inner development of the Kinder-garten idea. In Frau von Holzhausen, Fröbel had been deeply impressed with the sublime greatness of noble-hearted women; his own wife fully illustrated the theory of development to maturity. Deep in her heart she fondly nurtured the Kinder-garten, and hailed with warm enthusiasm a sphere of labour which was so thoroughly in sympathy with her love of mankind, and of children in particular. Her thoughts she expressed in the following lines:—

'Ein *leichter* sinn, der fasst es nicht;
Ein *leiser* sinn, der haszt es nicht;
Ein *lauter* sinn verspottets' nur;
Ein *tiefer* folgt allein der spur.'

A *light* mind comprehends it not; a *gentle* mind dislikes it not; a *haughty* mind will sneer at it; a deep thoughtful mind *alone* follows it.

The day of her funeral was a day of general mourning in Blankenburg and Keilhau. The ladies of both places decorated her coffin with flowers and garlands of orange-blossoms. Fröbel himself was like one close to the borders of eternity, and had not that mighty spirit within him, that incessantly bade him forget everything concerning himself, and follow only the divine call, upheld him, he could not without her have borne life. He took refuge in Keilhau under the gentle care of sympathising friends, whose warm love and veneration revived his drooping spirit.

But his great work did not allow him much leisure to pine over his loss. Besides, how could his troubled heart honour her memory in a manner more dignified and more worthy than by indefatigable devotion to her favourite idea! Such a gigantic mind, no disappointment, no difficulty, no failure could bend. Stronger and stronger he grew by these trials. What gave him this indomitable courage? It was his absolute confidence in the divine character of his mission. But this unshaken trust blinded him, as in the case of all such enthusiasts, to worldly interests. In his opinion, that fierce light that burned within him must find a vivid reflection in the minds of all thinking men and women. Failures and disappointments he would trace, not to his own mistakes, but to a necessary, natural, and, consequently, wise dispensation of Providence. The faintest sunbeam that smiled on his path, however, would make him exuberant with joy beyond all bounds, and would excite in him expectations which would have been inexplicable, and even absurd, in any one but Fröbel. All that he had hitherto done in the new system was, as it were, but a preliminary rehearsal. The presentation of the grand idea, the real *mise-en-scène*, was destined to be connected with the great festival, for the celebration of which Germany taxed to the utmost her powers of imagination. It was on the fourth centenary of the invention of the art of printing, on the first day of May, 1840, that he first published a plan, quite in keeping with his soaring spirit.

It was as follows:—the new institution was to comprise (1) a model school for the physical and intellectual culture of young children; (2) a seminary for teachers of both sexes; (3) a department for the invention and improvement of suitable games and means of occupation; and, finally, (4) a periodical magazine to serve as a nucleus for all persons interested in primary education.

The cost, estimated at 100,000 thalers (£15,000), Fröbel, in his child-like simplicity, thought the easiest thing in the world to realize. It only required one hundred earnest-minded ladies of influence, who would, of course, not object to taking each a share at a cost of about £1 10s. These ladies, who were to be considered founders, were each to engage to enlist ten other ladies under the same condition. In his opinion it was very simple, as there could not be the shadow of a doubt as to the success of this scheme. So confident was he, that he not only sketched detailed plans how the sums were to be advantageously invested, but actually engaged book-keepers, travellers, and others, all of whose claims Barop had afterwards to satisfy.

But of course this plan did not succeed. There was more cold indifference, more ignorance of his benevolent and humanizing labours than he had been aware of. In fact, in 1843, the number of shareholders amounted only to about one hundred and fifty.

Money or no money, the thing had to be done. To be, or not to be, was not the question which money had to decide. So the first Kinder-garten was opened, though not on such a vast scale as had been planned. The local authorities most cordially offered him a suitable building, with garden and playground, and he began work in full earnest.

In 1843 he published a book, 'Mutter und Koselieder,' containing about fifty songs and plays, with handsome pencil etchings. It is written with much warmth of feeling, and illustrates his views on infant life, and of early education in a highly attractive and interesting manner.

Much as has been said against the outward form and polish of the rhymes and poetical effusions, this book abounds in invaluable hints, not only to mothers, but to all who are desirous to study child-nature. It certainly is a real treasure for every Kinder-garten, not only because the peculiar features of the system are clearly indicated, but also because it is the starting-point for a rational and natural education, showing how the tender germs of all the human faculties must be nurtured and cultivated if they are to reach a healthful and satisfactory development.

Frau von Marenholz Bulow, the indefatigable champion of the Kinder-garten, says, with regard to this book: 'Such only as have no understanding of, and no eye for, the mind of a child—such as, forgetful of their own childhood, neither feel nor love nature, can afford to smile at these interpretations of the first infantine plays, as starting-points, as germs of mental development. But if the child's first plays and prattle have no connection with the old man's last deeds,

then where is a connection to be found in human life? where unity in man's inner development? Where this connection is clearly understood, where education leaves the thread which ties the child to the youth unsevered, there only the man will live and act strictly in accordance with the ideal of the youth. There only thorough men, real characters, will be found.'

As to Fröbel's poetry, it certainly offers much ground for adverse criticism as to its artistic merits. But to reject the whole system because of these outward deficiencies, is as unjust and as thoughtless as to condemn a man because his garments are not of the proper cut. First originators cannot be expected to produce their inventions in such a perfection as they appear in later generations. A visit to the 'Rocket,' Stephenson's remarkable engine in the museum at South Kensington, may prove, in its wholesome lessons, of immense benefit to such hasty critics.

(To be continued.)

—o—

Physiology.

BY ARTHUR NEWSHOLME, M.D. LOND.,

Gold Medallist and University Scholar, Physician to the City Dispensary.

CHAPTER X.—THE BLOOD—*(continued)*.

Composition of Serum.—100 parts of serum consist of about 90 parts of water, 8 to 9 of proteid matters, and 1 to 2 of fat, extractives, and saline matters.

The greater part of the proteid matter is serum-albumin, which coagulates on heating, rendering the serum almost solid. It is distinguished from egg-albumin by its not being coagulated by æther. The extractives are urea, sugar, kreatin, lactic acid, etc. The chief peculiarity of the saline matter of serum is the preponderance of chlorides and sodium salts over phosphates and potassium salts.

General Composition of Blood.—We have already given separately the composition of corpuscles and serum. It will be convenient to present here, in a tabular form, the general composition of blood.

In 100 parts the various constituents average—

Water	78·4
Serum-albumin	7·
Fibrin-forming substances	0·22
Red corpuscles (dry)	13·
Inorganic salts	0·6
Extractive, fatty, and other matters ...	0·78
	100·

Gases in Blood.—In addition to the constituents already named, blood contains oxygen, carbonic acid, and nitrogen in solution, which can be extracted by the mercurial air-pump. When this is done, it is found that from 100 volumes of blood, an average of 60 volumes of gas can be extracted, measured at 0°C, and a pressure of 760 mm. The composition of this varies in venous and arterial blood. Thus from 100 volumes

	Of oxygen.	*Of carbonic acid.*	*Of nitrogen.*
	VOLS.	VOLS.	VOLS.
Of arterial blood can be obtained	20	39	1 to 2
Of venous blood	8 to 12	46	1 to 2

(M. Foster.)

The oxygen in blood is not simply dissolved, as shown by the fact that it does not follow the general law of absorption according to pressure. It has been proved experimentally that serum only absorbs as much oxygen as the same quantity of water; the red corpuscles must therefore be the agents in the absorption of oxygen by blood. As 90 per cent. of dried red corpuscles consists of hæmoglobin, one might infer that this is the agent in the absorption of oxygen, and that this is the case we have already seen.

Most of the carbonic acid in blood is simply dissolved in it, and can be extracted by the mercurial pump. From 2 to 5 per cent. of it requires the addition of an acid to drive it off. It has been supposed that this is in loose combination with sodium carbonate or a phosphate of the same base.

Variations in Composition of Blood.—The composition of the blood is found to differ within certain limits in the same individual under various conditions, in different individuals, and at the same time in different parts of the body.

Each of the main constituents may alter in amount. Thus the water may vary according to the amount of drink taken, of exercise, and other circumstances from 70 to 79 per cent. Within these limits, however, its composition is fairly constant. This is of great importance in relation to the absorption of fluids from the alimentary canal; as these will only quickly penetrate the blood-vessels when they are of less density than the blood.

The albumin again may vary consistently with health from 6 to 7 parts in 100; and the fibrin from 0·2 to 0·3.

The blood of *men* usually presents a somewhat higher specific gravity than of women, and a relatively larger number of red corpuscles. During *pregnancy* the red corpuscles of women's blood diminish in number, while the quantity of white corpuscles and fibrin is increased.

Age has some influence. Fœtal blood is very rich in solid matter, which decreases during childhood, and rises during adult life, to fall again in old age.

When the red corpuscles of the blood are deficient in number, or do not contain the due proportion of hœmoglobin, the oxygen-carrying properties of the blood are materially interfered with. The consequence is that the oxidation processes of the body are hampered, and the patient suffers from shortness of breath on exertion, and is extremely pale. This condition is known as anæmia.

It will be convenient next to discuss the difference between arterial and venous blood, and then the exceptional character of the blood contained in certain veins.

Venous blood differs from arterial in general composition and in colour. (1) In *general composition* arterial blood contains rather more fibrin-forming materials, and rather less albumin and fat; also more oxygen and less carbonic acid. (2) The difference in *colour* is well known, but its cause has been the subject of much discussion. Thus it was supposed that carbonic acid rendered blood dark by causing the red corpuscles to become bi-convex, while oxygen made them bi-concave. It has been clearly proved, however, that the change of colour in blood is chiefly, if not entirely, owing to the oxygen in the lungs converting purple or deoxidised hœmoglobin into scarlet or oxidised hœmoglobin. In the laboratory, this may

be imitated by taking crystals of hœmoglobin and subjecting them to the vacuum of the mercurial air-pump. A definite amount of oxygen is given off, while the crystals become darker and more purple. The same change may be effected in a solution of hœmoglobin by passing in hydrogen to dissociate the oxygen from its loose combination with hœmoglobin.

The portal, hepatic, and splenic veins contain blood differing from ordinary venous blood. The portal vein before entering the liver receives the blood of veins from the stomach and intestines, and from the spleen. The *blood from the stomach and intestines* is usually deficient in solid matters, owing to dilution with the water absorbed, and contains an excess of albumin, as well as various soluble matters absorbed in the process of digestion.

The *blood from the splenic vein* is deficient in red corpuscles, but usually contains an excess of white corpuscles, as well as of albumin and fibrin.

The *blood from the portal vein*, combining the peculiarities of these two factors, is usually more watery, contains fewer red corpuscles and more albumin, and yields a less firm clot than ordinary blood. This analysis does not include the saline, saccharine, and other matters absorbed from the food.

The *blood from the hepatic vein*, which represents the blood of the portal vein after it has been acted on by the liver, contains less water, albumin, and salts than portal vein blood, but an increased amount of extractives, especially of grape sugar (Cl. Bernard.)

In addition to the above instances, blood is doubtless modified in its passage through every organ of the body, as each abstracts the particular nutrient matter it requires, and delivers into the blood its special excretory products. The blood leaving the kidney by the *renal vein* contains less water and salts than ordinary venous blood, and urea is probably absent from it.

Uses of the Blood.—The chief function of the blood is to serve as the great medium of exchange between the different tissues of the body. It carries to every part of the body the materials required for building up the various tissues, in addition to oxygen and oxidisable matter, which, by their combination, produce the chemical and other forces of the body. It brings away from all parts refuse matters, and conveys them to the excretory organs. And lastly, by means of its constant circulation, it warms and moistens every part of the body, and keeps its temperature uniform throughout.

Each constituent of the blood has its special uses. Thus albumin serves to nourish the various tissues containing it; fatty matters replenish the corresponding tissues, maintain the temperature of the body, and form an important part of such secretions as milk and bile; saline matters prevent decomposition of the blood, and aid its absorptive power for gases, besides other functions; while the red corpuscles are the oxygen-carriers for the system in general. The functions of the white corpuscles, apart from their being the source of red corpuscles, is somewhat doubtful; but it has been shown that they occasionally migrate into the tissues surrounding the capillaries, and they may thus have an important influence on nutrition and the development of new tissues.

Coagulation of Blood.—Blood when shed is perfectly fluid. In the case of man, it becomes viscid in about two or three minutes; and in from five to ten minutes it assumes the form of a complete jelly. This jelly is at first of the same size as the fluid blood from which it was formed; but in a few minutes drops of yellowish serum begin to ooze out, and these collecting, the clot or crassamentum to a corresponding extent diminishes in size, and finally floats in the serum. The upper surface of the clot is generally cupped. If a fragment of clot is examined microscopically, it is found to consist of delicate granular fibrils, in the meshes of which are imbedded red and white corpuscles. The horse's blood coagulates very slowly. The consequence is that the red corpuscles, after accumulating in rouleaux, have time to sink before a jelly is produced; a white meshwork, consisting chiefly of white corpuscles and fibrin, and known as the 'buffy coat,' being produced at the upper part of the clot. The same thing happens in human blood in inflammatory conditions.

The rapidity with which blood coagulates is affected by various circumstances.

(1) Moderate warmth (100-120° Fahr.) hastens coagulation, and a temperature near the freezing point of water will retard it indefinitely.

(2) Stagnation is favourable to coagulation, while uniform motion in a closed vessel tends to retard and make it imperfect.

(3) Contact with foreign matter, especially if the points of contact are numerous, favours greatly. Thus the presence of any rough projections in a vessel, or the insertion of any foreign body hastens the process. On the other hand, contact with the interior of a blood-vessel, or any other living tissue, will greatly retard, though it will not prevent coagulation, if the blood is stationary.

(4) The free access of air quickens coagulation, while imperfect aeration, as in death from suffocation (hanging, etc.,) retards it. Similarly, the exclusion of blood from the air, by pouring oil on its surface retards coagulation.

(5) The addition of less than twice the bulk of water quickens coagulation, while in larger quantities it retards it.

(6) The addition of 2 or 3 per cent. and upwards of alkaline and earthy salts retards coagulation; while in large quantities these prevent it altogether, unless the blood be diluted by water.

(To be continued.)

—o—

The New Class-Subject, 'Elementary Science.'

(What to teach, and how to teach it.)

BY RICHARD BALCHIN.

IN the notes of the short course of lessons on zoology to be given to Standard IV., we have reached the class 'Birds.' If the boys in the Standard are above the average in intelligence, three lessons may well be given on this subject—two on the general characteristics of birds, and one upon the classification into the seven orders. We must take this mode of grouping—unsatisfactory though it be—for want of a better. It may also be mentioned that the first birds to appear in the world—which, however, are extinct, but whose remains are found embedded in the rocks—were half birds and half reptiles. Thus was the class we are now considering linked with the class below it.

LESSON VII.

BIRDS (Circulation and Respiration).

Have a picture of the interior organs of a bird, and, if possible, dissect a fowl before the boys, and show these organs.

(1) Circulation.—The heart is of four chambers, like ours—two auricles and two ventricles. Venous blood enters the right auricle, passes to the right ventricle, thence to the lungs; thence to the left auricle, thence to the left ventricle, from which it is propelled throughout the body. No mixture of venous and arterial blood as in reptiles. Make a rough blackboard drawing to illustrate this circulation. Blood warm; warmer than ours; being more fully oxygenised. Pulsations very rapid; boys who have kept canaries must have noticed this.

(2) Respiration.—By lungs; but a bird's lungs or lights do not hang freely in the chest as ours do; they are in part fastened on to the ribs. The boys have perhaps seen their mothers 'truss' fowls; if so, they must have noticed that the lungs have to be *torn* away; they cannot be removed *entire*, as a sheep's lungs can. Also, the lungs open into 'air-sacs' in various parts of the bird's body, and even communicate with the interior of most of the bones, except in the case of very young birds; so that the bones are filled with air, instead of marrow.

Better at once dispel a very common error as to respiration generally. Boys, and even some grown up people, are constantly affirming that we 'breathe in oxygen, and breathe out carbonic acid gas.' Make the fact clear that the air inspired consists of about four parts by volume of nitrogen and one part of oxygen; the expired air has lost about one-fifth of its oxygen, and gained an equal quantity of CO_2 in its place. Birds do the same.

LESSON VIII.

BIRDS (Skin-covering and Mode of Birth).

Have some feathers, and two eggs; one hard-boiled.

(3) Skin-covering.—Feathers and down; never plates nor scales, nor hair, although in some birds, *e.g.*, the emu, the feathers approach the nature of hair. Notice the parts of a feather. (1) A horny tube, the 'quil.' (2) The 'shaft,' or central thickened portion; this is filled with a light, white spongy mass. (3) The 'webs'; these are continuations or expansions of the shaft, sideways. (4) 'Barbs,' branching off from the webs. Compare a feather with a fish-scale.

(4) Mode of Birth.—The young is hatched from an egg through the agency of heat from the body of the parent bird. The high temperature of birds is especially adapted for this. Break open an egg, and explain very briefly the different parts. (1) The shell, porous, hard, composed of lime. (2) A membraneous covering, or skin, slightly porous. (3) The white or albumen. (4) The yolk or yellow. Cut through the yolk of the hard-boiled egg, and note the grey spot; from this spot the chick begins to be developed.

LESSON IX.—MAMMALS.

Have pictures of duck-mole (ornithorhynchus), kangaroo, dolphin, whale, horse, cow, elephant, seal, lion, rabbit, bat, gorilla, man.

Of these, the lowest in the scale is the ornithorhynchus. It is in many points like a bird; in fact, among existing animals it is the link between birds and mammals.

If possible, show the internal organs of a rabbit and compare them with those of man, as shown in the model supplied by the School Board for London.

(1) Circulation.—Cut open a bullock's heart and show the four chambers. The blood circulates through these four chambers in the same way as in the case of birds. Recapitulate what this is. Show diagram of human heart and note the resemblance. Except in the character of the valves, there is no great difference between the heart of a bird and that of a mammal.

(2) Respiration.—By lungs, same as birds; but the lungs of a mammal are freely suspended in the chest and can be removed, entire. Note this in the case of the sheep's lights that boys have seen in butchers' shops. Also, the lungs do not communicate with air-sacs in various parts of the body as is the case with the lungs of birds. Recapitulate the facts as to the change which the air undergoes during its passage through the lungs. Note:—To show this in a striking manner, I have prepared an apparatus consisting of two Woulfe's bottles and a series of bent glass tubes. These are so arranged that upon applying my mouth to the end of a tube and breathing, the *inspired* air passes through some lime water in one bottle, and the *expired* air through lime water in the other. In the first bottle, the boys observe that the lime water undergoes no change; it remains perfectly clear; while in the second, it becomes milky in appearance, owing to the combination of the carbon dioxide in the expired air with the lime of the lime water, and consequent formation of calcium carbonate, which, unlike lime itself, is insoluble in water.

(3) Skin-covering.—By hair, partly or wholly. Never by feathers nor scales.

(4) Mode of birth.—Young brought forth alive, and nourished for a time upon a special fluid—milk—formed in the body of the mother. This is the distinguishing characteristic of mammals. Latin, *mammæ*, breasts; hence the name of the class. Boys who have kept rabbits and fowls will readily tell the difference in the mode of birth.

This completes the series of lessons, as far as the Fourth Standard. Here, in most schools, the teaching of Elementary Science as a class-subject ceases. Whatever science is taught in such schools to boys in Standards V., VI., VII., falls under the head of 'specific subjects,' and the place of 'Elementary Science' as a class-subject is taken by geography. It is no doubt felt that it would be a very unsatisfactory state of things if boys should pass through all their standards without any knowledge of geography. More than two class-subjects is not allowed, and one of these *must* be 'English.' As, however, there may be teachers who take 'Elementary Science' as a class-subject throughout the school, or perhaps take it in the Upper Division only, I shall proceed with the notes as heretofore. In my next article, therefore, I propose to place before my readers a syllabus of lessons for one year's work in 'Elementary Science' as a class-subject for Standard V.

(To be continued.)

HOLIDAY SONG.

T. CRAMPTON.

Allegretto.
1st TREBLE.
2nd TREBLE.
BASS.
1. Come to the fields, lit-tle lad-dies and las-sies, Leave for a-while all the les-sons and
2. Watch the brisk bees rov-ing hi-ther and thi-ther, Work-ing and stor-ing their har-vest of
KEY G. Allegretto. mf
books; Dance on the grass with the fro-lic-some breez-es, Swing on the tree-boughs, and
sweets; Fol-low the steps of the fleet-foot-ed squir-rels, Hid-ing a-way in their
play by the brooks: Drive home the cows from the hill-sides and hol-lows, Where they are
wood-land re-treats: Pluck the gold but-ter-cups, ga-ther the dai-sies, Thick in the
pas-tur-ing all the day through; Ga-ther wild ber-ries that red-den and ri-pen,
mea-dows as stars in the sky; Lis-ten, and hear the gay lark as it ca-rols—
Fed on the sun-shine, the rain, and the dew.
Hear the loud notes of the thrush in re-ply.
Symph.

SONG FOR MARCHING.

Moderato. Tempo marcato. T. CRAMPTON.

1st TREBLE.
2nd TREBLE.
BASS.
mf
1. March, (1) march, march and sing! One, two, three, four—keep the time!
2. Stop, (2) now, stop, and rest! While with hands the time we beat:
KEY C. Moderato. Tempo marcato. mf
Step firm! on-ward swing! Let your voi-ces with us chime! On, on,
One, two, they do best Who can go-vern hands and feet. One, two,
on we go! All our steps should sound as one! Keep time, thus to show
like the clock! (3) Now a-gain we on-ward go! Then we (4) scho-lars flock
How good or-der may be won.
To the play-ground in a row.
Symph.

(1) Keep step to the music, four steps in each bar, so that the footsteps be heard at the rests as well as at the notes. (2) Stop marching, and beat the time with the hands. (3) March onwards again. (4) March off, if convenient, to the playground.

Article 106 (*b*).

Merit Grant in Infant Schools.

BY MRS. MORTIMER,

Lecturer on Kinder-garten at the Home and Colonial Training College, London.

Section II.—Phenomena of Nature.

LESSON—THE SUN.

WHEN do you go to bed? How long do you stay in bed? All night. Why do you not go to bed in the day-time? Because it is light, and we can see to run about and play and do our work. What gives us light in the day-time? The sun. Where is the sun? High up in the sky. When do you see it first? In the morning, directly we wake up. It very often wakes us, because it shines so brightly in at our windows. It is shining in the sky very early in the morning, long before some of us are awake. What does the sun look like? A large ball. Do you like to look at the sun? No; it makes our eyes ache. Do you know why it makes your eyes ache? Because it is so very bright. Is the sun always so very bright? No; sometimes we can look at it quite well; but that is when there is a cloud in front of it. Does it always look the same? No; sometimes it is very red, like fire, and another time it is a bright yellow colour, like gold. Do you always see the sun in the same place? I wonder if any one has ever noticed out of which of these windows he can see the sun in the morning, and which in the evening? That is right; if you look out of this window (teacher pointing to the east) directly you come to school, you will see the sun. Can you see the sun there now? No. Who can see the sun now? You cannot see it at all. Well, I will let Mary go into the playground and look for the sun; then she can come back and tell us where it is. Well, where did you see it, Mary? Over the school. Yes, at this time in the morning the sun is high up in the sky over our heads. Where do you see it the first thing in the morning? Yes; and then it gradually gets up higher and higher, until it is high up over our heads. Does it stay there? No; if you were to watch it you would see that it then goes down lower and lower, until you can see it out of this window (pointing to the west), and then if you still watch it you will see it sink still lower, until it goes quite away, and you cannot see it any more. What happens when it has quite gone? It begins to get dark. Does it get dark all at once? No; it is light at first, then it gradually gets quite dark. What are all little girls and boys doing when it is dark? Yes, they are all sleeping. When will they wake up? In the morning.

All look at the window out of which we see the sun in the morning. Now, that part of the sky where we see the sun in the morning is called the east. We say 'the sun rises in the east.' The children should here repeat, 'The sun rises in the east'; they should also be made to point to the east. Now look at the window out of which we see the sun in the evening. What did I tell you the sun does in the morning? It rises, and then it gets higher and higher, until at midday it is over our heads. What does it do then? It goes down lower and lower until we lose sight of it. When does it do this? In the evening. We say the sun sets in the evening, and the part of the sky where it sets we call the west. The children should then repeat, 'The sun sets in the west.' Point to the west.

You told me that the sun gives us light; there is also something else that we get from the sun; do you know what it is? How do you feel if you stand in the sun? We feel very hot. What makes you feel so hot? The sun. Then the sun gives light and heat. Do you know what good this heat does to the flowers and fruit in the fields and gardens? It makes them grow. Yes, it makes the fruit and flowers grow, and then it makes the fruit and corn get ripe. Do we like all these things to get ripe? Why? They are all things that we eat, and we cannot eat them until they are ripe.

If you put your mother's butter in the sun, what happens to it? And if the sun shines when there is ice or snow on the ground, what happens to it? The heat from the sun makes these things soft, but what does it do to the mud in the road? It makes it quite hard. Then you see the heat makes some things soft and others hard. The children should name some of these things.

If you go out when the sun is very hot, how does it make you feel? Very tired. Yes, and it often makes your head ache. Do you know what you should be very careful to put on when you go out in the sun? Yes, you must never go out in the sun without putting on your hat. Some people who are obliged to work in the sun all day have very bad headaches, and sometimes they are very ill and die. We say they have sun-stroke. Would you like to have sun-stroke? Then what ought you to be very careful about?

Which part of the year is the sun the hottest? And when does it shine for the longest time? Sometimes in the winter we do not see the sun all day, sometimes for two or three days. Where is the sun then?

There is one day in the summer that we call the longest day, because the sun shines longer on that day than on any other. And there is one day in the winter called the shortest day, because the sun does not shine so long on that day as on the others.

An exercise should then be given on the position of the cardinal points and how they are determined.

Section III.—Scenes of Common Life.

LESSON—A GARDEN.

The teacher should begin to question the children about their homes as follows:—How many of you have a garden? Where is it? We have two. Where are they? One in front and one at the back of the house. Have you all two gardens? No. Some of you have only a garden at the back of the house, and some have them only in the front. There is one little boy who says he has not any garden. So you see some of you have two gardens, some have one, and some have none at all.

Are all your gardens the same size? No; some are very much smaller than the others. Do you like to have gardens to your houses? Why? We like to play in them, and to see the flowers. Yes; they are very nice to play in. Now, I want you to think about your gardens, and tell me what you do in them. Well, one little girl says she only plays in hers, but Mary says she puts flowers in hers. How many of you have flowers in your gardens? Do you put the flowers in yourselves? No; our father sees to them. Yes; and he does not like you to touch the flowers. Why not? Because we might spoil them. Some little boys and girls have a piece of garden all to themselves, so they can put in what they like. Now, will you tell me the different parts of the garden? The paths. For what do we use them? For walking on. But may you not walk on all parts of a garden? On which parts must you not walk? On the beds. Which are the beds? Those parts that have things growing in them. Then we have found out two parts of the garden—the paths and the beds. What is there all round the garden? A wall or fence. What is the use of this? That is right; it separates one garden from another, so that each person has his own garden. What do we often have in the middle of the garden? Some more beds or some grass. Yes; we have the grass plat, the paths, the flower beds, and then the walls. Will you tell me of what the paths are made? Generally of gravel. What has to be done to the paths to make them nice? They have to be rolled. What does this do? It makes them hard and smooth. What does your father use to do this? A garden roller. Can you use the roller? No; it is too heavy. Would it do if it were light? No; it would not make the paths hard. Sometimes pieces of grass grow in the paths, and these you must pull up directly, for they spoil the look of the walks. If you have a grass plat in the middle of your garden, what has to be done to it? Yes; the grass has

to be cut and rolled also just like the gravel. If the grass is not kept cut it grows very long, and then looks very untidy. Do you know another name for a grass plat? Yes, it is called 'a lawn.'

Now tell me some of the flowers that you have in your garden. Geraniums, marigolds, nasturtiums, fuchsias, sunflowers, mignonette, etc. Some time ago we had daisies, crocuses, daffodils, and tulips, etc. Yes; they are all very pretty when they bloom. Do you know what your father did to make these flowers come? Yes; he put little seeds into the ground, and then the seeds gradually grew into the plants. Do you not think it very wonderful that these plants should grow out of those little seeds? Did your father sow seeds for the geraniums and fuchsias? No; he put small plants in the ground, and they grew into the large ones we now have. Where did he get them? From the gardener. Yes; some day we will have a long talk about the gardener. You must be very careful when you play in the garden not to break the flowers or dig up the paths. And you should not leave your toys about the garden, for they make it look untidy.

Now I expect some of you have seen other things growing in the garden besides flowers. Well, Harry, what do you say? I have seen onions, potatoes, and cabbages. And you, Tommy? Apples and pears. What do we call the things Harry named? Vegetables. And those Tommy named? Fruits. Do you know what kind of garden we call the one where vegetables and fruits are grown? Yes; a vegetable garden. And what do we call the one we first talked about? A flower garden. Which is generally the larger? The vegetable garden. Why do people plant vegetables in their gardens? Do they look pretty? They want them to eat. Do the apples and pears grow on plants like the cabbage, potato, etc.? No; they grow on trees. Yes; and so do plums, cherries, etc. Then there are some things that grow on bushes. Can you tell me some? Currants, gooseberries, and strawberries. No, strawberries do not grow on bushes; they grow close to the ground on little plants. You see, then, that the vegetables grow on plants, and some of the fruit on trees, and some on bushes, while one little fruit grows on a plant. What is its name? The strawberry.

The teacher should recapitulate the parts and uses of a garden and the different things seen in a garden.

Section IV.—Common Employments.

LESSON—THE BUILDER.

A lesson on the builder will really be an introduction to a course of lessons comprising the following trades: bricklayer, carpenter, glazier, painter, plumber, etc. The teacher, therefore, instead of entering fully into particulars, which would be given under each trade, should see that the children recognise the different sets of men engaged, and the materials individually used by them.

Now, children, we are going to talk to-day about house-building. What do you call the man who builds houses? Probably to this question the teacher would have the following answers: carpenter, bricklayer, builder, etc. She would have to tell the children that the man who sees to the whole of the house is called a builder, and that the carpenter, bricklayer, etc., only do certain parts of the house. The teacher should then repeat the question, What is a builder? so that all the children should answer it properly. The builder gets men to come and work for him. What does he give them? Money. What do we call this money? Wages. Do the men all do the same work? Oh no. Some men are bricklayers, others are carpenters. Now, I will be a builder, and you shall help me to build a house. What shall we first have to do? Build the walls. Not at first; we shall have to dig out the ground. Do you know why? Well, I will tell you. The house would fall down if we tried to build it on the top of the ground. First of all, we must get some men to dig out some of the ground. Then the men would come and build the walls. What do we call these men? Bricklayers. Why? Because they lay the bricks on each other. Are houses always built of bricks? No; sometimes they are made of stone, and also of wood. Well, Harry, what do you say? Sometimes part of the house is stone and the rest of bricks. We must not forget to leave some large holes in the walls. Do you know why we leave these holes? Yes, for the windows. The woodwork of the windows is put in while the bricklayers are building the walls. Then the thick pieces of wood on which the floors are made are put down. What do you call the men who do this work? Carpenters. What else do they do? They nail the floors down and put in the doors. And anything else? Yes, the stairs. If you go to a house when the men are only just beginning, you will not see any stairs. How do you think the men manage without the stairs? They use ladders, and also long poles with boards. Yes, we call these poles and boards the scaffolding. I think that is a long word for you; but you must think of it as three small ones—scaf-fold-ing. Now, what do you mean by the scaffolding? Do you think the carpenters made your school stairs? No. Why not? Because they are made of stone. What do you call the men who do the stonework? They are called masons. Can you tell me what they do in the house? They make the hearths, mantelpieces, and the steps. When the carpenter has finished the windows, what else has to be done to them? The glass must be put in. Who does this? The glazier. Yes, he puts glass in all the windows. Where else do we have glass? In some of the doors. What do we call the top of the house? The roof. Who makes the roof? You do not know; well, look at this model. What are these? They are slates. Yes; and the man who does this work is called 'a slater.' Have you seen anything else used for the roof? Yes, sometimes tiles are used. The teacher might tell the children that in some places straw is used for the roof, and sometimes lead, iron, or zinc.

Now the house is built; but I do not think you would like to live in it yet. What has to be done to it? What colour is the wood? White. Do you live in a house with the wood like this? No; the wood is painted. Well, then, who shall we have in the house now? The painters. They will have a great deal of work to do. Then, while they are doing their work, we have the men in to make the walls look nice. What do we put on the walls? Paper. And what do you call the men who put the paper on the wall? Paper-hangers. But we have forgotten the ceilings of the rooms. These are done before the painter and paper-hanger come. Now I will show you how they are made. Do you remember the thick pieces of wood to which the floors were nailed? Well, under the floor comes the ceiling of the room below. Thin strips of wood called laths are nailed to these thick pieces of wood, and then the plasterer comes and puts the ceiling on. The teacher should here show some plaster. When this is dry, the whitewashers make it nice and white. And now the house is nearly ready. The bell-hangers come and put in the bells and the wires. Why are wires wanted? Tell me something else we want in the house. Water-pipes. Who sees to this? Men called plumbers. Yes, and they do some of the work before the painter comes. And what else do we want? You do not know. The builder has to send the locksmith. What has he to do? He sees to all the locks. Then the gas-fitter is wanted; and there are many other things that the builder has to do before the house is finished. So you see the builder must not be lazy, and he must keep coming to the house to see what is wanted next.

Summary.—The children should be asked to name the different sets of men employed, viz.:—Bricklayers, masons, carpenters, slaters, glaziers, plasterers, whitewashers, painters, paper-hangers, bell-hangers, locksmiths, plumbers, and gas-fitters. Then the various materials used should be written down after the children have mentioned them. For a recapitulatory exercise the children might write the different trades on their slates, and against them the materials used by the workmen. This could be done from memory, or from the summary on the blackboard.

LESSON—THE BRICKLAYER.

Apparatus.—A good picture, showing the man at work, and some of the tools with which he works. A brick, sand, lime, hair, trowel, model of hod, small rule and plumb, and a small level.

Now, children, we are going to talk about the man who makes the outside of the house. Of what does he make it? Of bricks. What do we call the man? A bricklayer. Why? Would you like to know how he puts the bricks together? Who has ever watched the bricklayer at work? Does he use anything besides the bricks? Yes, he has something that looks very much like mud. What does he do with it? He puts it on the bricks, and then puts other bricks on the top of it. And what do we call this? It is called 'mortar.' And what use is the mortar? It sticks the bricks together. Some day I will tell you how the bricks are made, but now I can only tell you about the mortar. It is not mud; it is made of lime and fine sand. Have you seen the men sifting the sand? Did you see the large sieve standing up? How does your mother sift her cinders? Do the men sift the sand in the same way? No, they have so much to sift. Yes, and it would make them very tired, and take them longer to use sifters like your mother's. They stand a very large one up nearly straight. Look at the picture, and tell me how the sieve is standing. It is on the slant. The men then throw the sand from their shovels against the sieve, and then what happens? The fine sand goes through, and falls behind the sieve. And what falls in the front? All the stones and other things which were in the sand. There is something else the men want to mix the lime and sand. They must have water. Yes, and in the summer time they use more water than in winter. Do you know why? Because the mortar dries quickly when the weather is hot. Then there is something else they put in good mortar to make it stick better. Look at this old dry piece of mortar. See, I am breaking it. It is very hard, and I have to hit it very hard to break it up. Now what else can you see? A great many little hairs. Yes, these hairs make the mortar much stronger. They are scraped off the skins of animals, especially that of the cow.

Now of what shape are the bricks? They are oblong. The teacher should here let the children compare the shape of the bricks with the oblongs in Gift IV. These they use in building, and call bricks. Of what colour are the bricks? Sometimes they are white, sometimes red, sometimes a light yellowish brown, etc.

We have talked about the things used to make walls, and now you may tell me about the tools the bricklayers use. Yes, they have a trowel. For what do they use it? To put the mortar on the bricks. Sometimes they want to break the bricks, and then they use the trowel also. The bricklayer holds the brick in one hand, and gives it a quick blow with the trowel, and this breaks the brick. See, here is a trowel. Can you tell me about any other kind of trowel? Yes, the gardener uses a trowel. Is it like this one? Oh no, it is very different. This one is flat, and the one we use in the garden is partly round. What else have you seen bricklayers using? Yes, he sometimes uses a hammer, but this, again, is different to the carpenter's. Look at this one, and tell me how it differs from the other. It is sharp at one end, like a chopper. Yes, the bricklayer uses it to cut the bricks. Have you seen the men carrying bricks? Show me on this picture which tool they use. Can you see a small one on the table? Yes, here it is. We call this a hod. Where does the man carry it? On his shoulder. Do you see this nice cushion made of hair and leather? What do you think is the use of it? It keeps the hod from hurting the man's shoulder. Which part does he hold? The long handle. Do you think you could carry a hod full of bricks? It is a heavy load for a man, especially when he has to go up a high ladder. Have you seen anything else in the hod? Yes, sometimes the men carry mortar. On high buildings the builder often has the bricks and mortar pulled up by long ropes, and then the men do not have to carry the heavy hod up the high ladders. Now, the bricklayer wants to know whether his wall is quite upright, so he has something that he can place against the wall, and by looking at it he can see if the wall has been properly built. Would you like to see one of these things? Here is one. We call it a plumb-rule. You see the piece of lead hanging in the middle? This is called the plummet. How is the plummet held in its place? By a piece of string. Well, the bricklayer puts the rule like this against the wall, and then if the plummet swings quite in the middle he knows that the wall is right. Now look at the plummet; it does not swing in the middle of the rule; this shows that the easel is on the slant. When the bricklayer finds the wall thus, he has to alter it. Then the bricklayer wants to keep the rows of bricks on a level, or, as we say, horizontal. Look at the blackboard, and I will show you this long word—hor-i-zon-tal. Now say the word. What does it mean? Show me something that is horizontal. The bricklayer uses a line. It is a long piece of string, with large pins. What are the pins for? To stick into the wall. When he has stretched the line along, he uses a little thing like this, called a level, to see if his line is quite straight along or level. What else can you say? Horizontal. Do you see the little bubble inside the glass? When this is in the middle it shows the line is level. See, if we put the level on the table, where is the bubble? In the middle. Now put it on the desk, and then what will you say? The bubble is at the end. Yes, and this shows us that the desk is slanting. There is one other tool used by bricklayers. Have you seen anything like this? Yes, it is a square. Well, the bricklayer uses this for the corners. We want the corners of the walls kept square. You take this square, and put it in the corner of the room. What do you notice? The square fits into it. That is the way the bricklayer uses the square. Do you know what has to be done before the bricklayer begins building a wall? Well, the next time you know there are going to be some houses built, you must go and see what the men do first. That is right. You see Harry knows. They dig out some of the ground, and then they fill in this hole with stones, and beat them down. Sometimes they put some concrete. This looks something like mortar with stones mixed with it. What is this part of the house called? The foundation. Yes, and the builder is very particular about the foundations, for he knows the house will not be strong if the foundations are not well made.

Sometimes you have seen men doing something to the fronts of old houses. Do you know what I mean? Painting them. I mean they were doing something to the bricks. Do they paint the bricks? Well, perhaps you have not noticed, so I will tell you. Sometimes the mortar between the bricks wears away, or gets very loose. The bricklayers come and put new mortar between the bricks, so as to fill them up. This is called pointing. This makes the walls quite strong, besides making them look clean and new.

The bricklayer always has some one to help him, called a labourer. Do you know what the labourer has to do? Yes, carry the bricks and mortar to the bricklayer. Yes, he has to fetch whatever the bricklayer wants; so that the bricklayer does not leave off to fetch his own things.

Summary.—For a recapitulatory exercise the children might write out a list of things used by the bricklayer, describe them, and name their uses.

(To be continued.)

Self-Teaching Standard Needlework Manuals.

Mrs EMILY G. JONES, Directress of Needlework to the Education Department, will shortly issue a series of cheap STANDARD NEEDLEWORK MANUALS, profusely illustrated with diagrams, etc., and designed with a special view to give **self-help** to scholars in this important subject. We understand that Mr. Joseph Hughes will be the publisher.

Recent Inspection Questions.

[The Editor respectfully solicits contributions—all of which will be regarded as STRICTLY PRIVATE*—to this column. For obvious reasons, it cannot be stated in which district the questions have been set.]*

Arithmetic.

STANDARD I.

(1)	(2)	(3)
64	920	306
307	736	291
940		
856	184	15
17		
2184		

5 times table.

STANDARD II.

(1)	(2)	(3)	(4)
146	20,601	9)36,073	50,792
7009	7092		16
830		4008+1	
5206	13,509		812,672
17			
13,208			

STANDARD III.

(1) Multiply four hundred and seventy thousand and eighty-four by nine hundred and eight.
Ans. 426,836,272.

(2) £	s.	d.	(3) £	s.	d.
530	11	10	2769	13	10
379	15	$4\frac{1}{4}$	7039	13	$8\frac{3}{4}$
			93	11	$8\frac{1}{2}$
150	16	$5\frac{3}{4}$	4138	19	8
			16	18	$7\frac{1}{4}$
			14,058	17	$6\frac{1}{2}$

(4) A man spent at two different times £827 14s. and £213 11s. 4½d. How much had he remaining out of £1500? Ans. £458 14s. 7½d.

STANDARD IV.

A.

(1) Multiply £86 13s. 4½d. by 75.
Ans. £6500 3s. 1½d.

(2) Divide seven hundred thousand and eighty pounds sixteen shillings by one thousand nine hundred and seventy-six. Ans. £354 5s. $10\frac{9}{19}$d. +448.

(3) Reduce 70,008 yards to furlongs.
Ans. 318 frls. 8 pls. 4 yds.

(4) A grocer buys a barrel of sugar of 10 cwt. for £15, and sells it at 3¾d. per lb. How much did he gain? Ans. £2 10s. gained.

B.

(1) Divide eight thousand four hundred and eighty pounds twelve shillings and sevenpence by ninety-seven.
Ans. £87 8s. 7d.

(2) 9,037,250 ft. to miles.
Ans. 1711 miles 1056 yds. 2 ft.

(3) 26 cwt. 3 qrs. 17 lbs. to ozs.
Ans. 48,208 ozs.

(4) Supposing the average grant for each girl to be 11s. 2d., and for an infant half as much, how much is the grant earned for 113 girls and 49 infants?
Ans. £76 15s. 5d.

C.

(1) Multiply £367 16s. 4¼d. by 246.
Ans. £90,483 3s. 1½d.

(2) Divide one hundred and fifty thousand pounds fifteen shillings by one thousand five hundred and ninety. Ans. £94 6s. 9½d. +780.

(3) How many hours are there in the years 1884 and 1885? Ans. 17,544 hours.

(4) A manager's salary is £237 5s. yearly. How much is that monthly and daily?
Ans. 13s. a day; £19 15s. 5d. a calendar month.

D.

(1) Multiply £64 16s. 7½d. by 68.
Ans. £4408 10s. 6d.

(2) Divide £7063 0s. 11½d. by 806.
Ans. £8 15s. $3\frac{0}{4}$+454.

(3) Seven million and seventeen lbs. to tons.
Ans. 3625 tons 0 cwt. 0 qr. 17 lbs.

(4) How often is 1s. 4½d. contained in £2 12s. 3d.?
Ans. 38 times.

STANDARD V.

(1) 860½ at £12 19s. 7½d. each.
Ans. £11,170 7s. $3\frac{3}{4}$d.

(2) $\frac{1}{3}+\frac{3}{7}+\frac{7}{8}$. Ans. $1\frac{10}{168}$.

(3) 14 yds. at 1s. 11d. a yard; 10½ yds. at 8s. 9d. a yard; 30 yds. at 5s. 9d. a yard; and 10½ yds. at 1s. 11½d. a yard. Ans. £15 11s. 9¼d.

(4) An excursion from Plymouth to Dover costs £2 16s. 3d. each for 47 persons. It was put down in the books for £131 10s. Find the amount of error, and express answer in farthings.
Ans. 660.

STANDARD VI.

(1) If 10 horses plough 15 acres, how many does it require to plough 170 acres? Ans. $113\frac{1}{3}$.

(2) $\frac{8}{9}\times 5\frac{1}{4}\times\frac{3}{14}\times\frac{17}{1}$; divide answer by $\frac{4}{11}$.
$11\frac{1}{16}$. Ans.

(3) What is the simple interest on £1050 for 3½ years at 4 per cent.? Ans. £147.

(4) If a servant receives 25 guineas for one year, how much ought she to receive if she stops from August 27th to January 13th?
Ans. £9 19s. $11\frac{13}{73}$d. (139 days).

STANDARD VII.

(1) What is the average population of the following towns, 34,729, 46,238, 89,726, 51,384, 27,905, and 60,350? Ans. 51,722.

(2) A shipowner insures his vessel valued at £8350 at $4\frac{1}{8}$ per cent. The cargo is worth £4270 at 3½ per cent. What was the total amount of insurance paid to the company? Ans. £500 3s.

(3) If 5 men reap 125 acres in 15 days, in how many days will 20 men reap 75 acres?

Ans. $2\frac{1}{4}$ days.

(4) A clerk's salary is £191 12s. 6d. per annum; what ought he to receive for 60 days; and how much would he lose in last 3 months of the year if his wages were reduced 2s. 8d. a day?

Ans. £31 10s.; £12 5s. 4d.

Grammar.

STANDARD IV.

Parse:—

The little boy in the next house sometimes catches a cold in the head.

With what parts of speech are adverbs used?

Parse:—

I bought his book, and he gave me five shillings for it.

STANDARD V.

Parse and analyse:—

Soon heavier clouds made their appearance over the whole sky.

Form as many adjectives as you can from the nouns 'man' and 'grace.'

STANDARD VI.

Parse the words *in italics*, and analyse:—

When the sun arises, he *very soon* puts to *flight* the vapours with *his searching* beams.

Explain 'ex,' 'in,' 'inter,' as prefixes, and give examples and explanations.

STANDARD VII.

Parse the words *in italics*, and analyse:—

The poor man *whose* leg *was broken, will be taken* to the hospital *whenever* the carriage *comes round.*

Explain:—

*inter*min*able.*
hero*ine.*
abbe*ss.*
*incon*ceivable.

Composition.

STANDARDS VI. AND VII.

'The Atlantic Ocean.'

Music.

SINGING TEST.

Time | 1 : 1 : 1 | 1 :—: | 1 :—:— | 1 : 1 1 : 1 | 1 :—:—

Sing—**m s d' s m s d' ta l s l t d',**

—o—

ANSWERS TO ARITHMETICAL QUESTIONS IN 'THE SCHOLAR' FOR SEPTEMBER, 1884.

STANDARD III.

A. 1. 7,642,285,200.
2. 467+32.
3. 1014+22.
B. 1. 1239+1671.
2. 796+5501.
3. 913+212.
C. 1. £323 6s. $3\frac{3}{4}$d.
2. £11,780 15s. $2\frac{3}{4}$d.
3. £570 16s. $5\frac{1}{2}$d.
D. 1. £28,196 17s. $11\frac{1}{4}$d.
2. £25,972 18s. $4\frac{3}{4}$d.
3. £9627 5s. $8\frac{1}{4}$d.
E. 1. £280 10s. 10d.
2. £232 18s. $6\frac{1}{4}$d.
3. £5858 8s. $5\frac{1}{4}$d.
F. 1. £2 17s. $0\frac{3}{4}$d.
2. £80 8s. $6\frac{1}{4}$d.
3. 4 times.

STANDARD IV.

A. 1. £216,844 2s. $7\frac{3}{4}$d.
2. £6074 9s. $11\frac{1}{4}$d.
3. £364,118 9s. 3d.
B. 1. £27 8s. $1\frac{1}{2}$d. +227.
2. 2s. $0\frac{3}{4}$d. +2763.
3. £571 16s. $1\frac{1}{4}$d. +4.
C. 1. 33,816.
2. 15 fur. 10 po. 1 yd. 1 ft. 8 in.
3. 1 ac. 2 ro. 15 po.
D. 1. £30 12s.
2. 71 yds. 1 qr.
3. £4 9s. $9\frac{3}{4}$d. +39.
E. 1. £15 13s. $10\frac{1}{2}$d.
2. £2216 18s. $11\frac{1}{4}$d.
3. 266,719
F. 1. £19 16s. 8d.
2. 32 st. 13 lbs.
3. £35 15s. 4d.

$9\frac{1}{2}$ yds. 6 ft. 128 in.
or
10 yds. 0 ft. 20 in.

STANDARD V.

A. 1. £165 15s. $1\frac{1}{2}$d.
2. £3475 18s. 9d.
3. £71,849 13s. $8\frac{1}{2}$d.
B. 1. £4259 18s. $3\frac{3}{4}$d.
2. £14 6s. $0\frac{1}{2}$d.
3. £317 12s. $7\frac{1}{2}$d.
C. 1. £29 12s. $8\frac{1}{4}$d.
2. 3 qr. 13 lbs. 12 oz.
3. 36 months.
D. 1. $1\frac{23}{60}$.
2. $\frac{11}{12}$.
3. $\frac{23}{100}$.
E. 1. £15 11s. $0\frac{1}{2}$d.
2. £144 14s. $1\frac{1}{2}$d.
3. £32 2s. $10\frac{1}{2}$d.
F. 1. £26 6s. 6d.
2. £1 3s. 4d.
3. £22 3s. $8\frac{1}{2}$d.

STANDARD VI.

A. 1. 78 and 72.
2. $\cdot 06451612903225\overline{8}$.
3. £3 8s.
B. 1. £3 17s. $8\frac{3}{11}$d.
2. 18,670$\frac{1}{2}$.
3. $4\frac{3}{8}$ hrs.
C. 1. 2500.
2. £9 6s. $2\frac{1}{2}$d.
3. 11 mos.
D. 1. 468$\frac{4}{7}$ oz. or 29 lbs. $4\frac{4}{7}$ oz.
2. ·4725.
3. 3 hours.
E. 1. £100.
2. £20.
3. £4 2s. 6d.
F. 1. 6 times.
2. 3185.
3. 1000.

STANDARD VII.

A. 1. 10 p.c
2. Int. £1 15s. $11\frac{13}{18}$d.
Amt. £291 15s. $11\frac{13}{18}$d.
3. 10 p.c. and 12 p.c.
B. 1. 20 p.c.
2. £40.
3. $18\frac{3}{4}$.
C. 1. £90 1s $2\frac{1}{16}$d.
2. £1 2s. 6d.
3. $33\frac{1}{3}$.

ANSWERS TO ARITHMETICAL QUESTIONS IN 'THE LITTLE LEARNER' FOR SEPTEMBER, 1884.

STANDARD I.

(1) 2628
(2) 109
(3) 279
(4) 2817
(5) 692
(6) 185
(7) 1686
(8) 291
(9) 169
(10) 2247
(11) 855
(12) 197
(13) 1901
(14) 472
(15) 99
(16) 3825
(17) 97
(18) 420
(19) 2119
(20) 619
(21) 681
(22) 2767
(23) 27
(24) 107
(25) 1656
(26) 94
(27) 157
(28) 1964
(29) 179
(30) 109
(31) 3836
(32) 187
(33) 187

STANDARD II.

A. (1) 31,209
(2) 1986
(3) 32,278,848
(4) 3380+6
B. (1) 34,961
(2) 16,965
(3) 58,666,410
(4) 2662+4
C. (1) 899
(2) 42,336,822
(3) 271+28
D. (1) 8978
(2) 36,278,928
(3) 1932
E. (1) 10,884
(2) 6,737,454
(3) 2170
F. (1) 17,299
(2) 56,532,450
(3) 4665+5
G. (1) 415,760
(2) 19,599
(3) 97,466,250
(4) 3350+3
H. (1) 8891
(2) 927,080,000
(3) 4462+6
I. (1) 7,442,786,400
(2) 3,517,515,600
(3) 3,209,365,800
(4) 313,693,380

ANSWERS TO ALGEBRA QUESTIONS IN THE 'SCHOLAR' FOR SEPTEMBER, 1884.

EXERCISE XXXIV.

(1) $x^2+14x+49$; $x+7$
(2) $x^2-14x+49$; $x-7$
(3) $x^2+80x+1600$; $x+40$
(4) $x^2+\frac{1}{6}x+\frac{1}{144}$; $x+\frac{1}{12}$
(5) $x^2+4ax+4a^2$; $x+2a$
(6) $x^2+8mx+16m^2$; $x+4m$
(7) $x^2-\frac{y}{6}x+\frac{y^2}{144}$; $x-\frac{y}{12}$
(8) $x^2-\frac{2}{3}x+\frac{1}{9}$; $x-\frac{1}{3}$
(9) $x^2+\frac{1}{5}x+\frac{1}{100}$; $x+\frac{1}{10}$

EXERCISE XXXV.

(1) 2, −12
(2) 3, −1
(3) 10, −11
(4) 3, −17
(5) −1, −12
(6) 10, −110
(7) 3, 2
(8) 1, $-\frac{1}{2}$
(9) 5, −4
(10) 24, $-23\frac{1}{2}$
(11) 6, $-4\frac{1}{2}$
(12) 10, −2
(13) 6, $3\frac{1}{2}$
(14) 2, $-\frac{2}{7}$
(15) 4, 1
(16) 3, $-\frac{11}{2}$
(17) 5, −1
(18) $-a\pm\sqrt{a^2+b^2}$
(19) $\frac{\pm\sqrt{p^2+4q}-p}{2}$
(20) $\frac{\pm\sqrt{b^2+4ac}-b}{2a}$

ANSWERS TO
Pupil Teachers' Examination Papers.
JULY 26TH, 1884.
FIRST YEAR.
Pupil Teachers at end of First Year.

Three hours and a half allowed.

Arithmetic.

MALES.

1. By what must $3\frac{1}{7}$ of $1\frac{2}{3}+1\frac{1}{4}$ be divided in order to produce a quotient equal to $3\frac{1}{4}-2\frac{3}{4}$ of $\frac{1}{6}$.

Divisor = Dividend ÷ Quotient.

$\therefore$ $3\frac{1}{7}$ of $1\frac{2}{3}+1\frac{1}{4}\div 3\frac{1}{4}-2\frac{3}{4}$ of $\frac{1}{6}$
$=(\frac{2}{3}\times\frac{3}{8})+\frac{11}{28}\div\frac{3}{4}-(\frac{11}{4}\times\frac{1}{6})$
$=(\frac{11}{12}+\frac{11}{28})\div(\frac{3}{4}-\frac{11}{24})$
$=\frac{880+231}{168}\div\frac{528-385}{168}$
$=\frac{1111}{168}\times\frac{168}{143}$
$=7\frac{7}{13}$. Ans.

2. Find the value of

$$\left(\frac{8\cdot75}{\cdot0625}-8\cdot75\times\cdot024\right)\div 3\cdot125.$$

$$\left(\frac{8\cdot75}{\cdot0625}-8\cdot75\times\cdot024\right)\div 3\cdot125$$
$=140-\cdot21\div 3\cdot125$
$=139\cdot79\div 3\cdot125$
$=44\cdot7328$. Ans.

3. Find the value in yards, feet, inches, of—

$\frac{2}{15}$ fur. $+\frac{5}{9}$ pole $+\frac{7}{24}$ yd. $-\frac{1}{8}$ in.

		yds.	ft.	in.
$\frac{2}{15}$ fur. $=\frac{2\times220}{15}$ yds.	=	29	1	0
$\frac{5}{9}$ pole $=\frac{5\times11}{9\times2}$ yds.	=	3	0	2
$\frac{7}{24}$ yd. $=\frac{7\times36}{24}$ in.	=			$10\frac{1}{2}$
		32	2	$0\frac{1}{2}$
$\frac{1}{8}$ in.	=			$\frac{1}{8}$
		32	1	$11\frac{3}{8}$

4. A and B had equal sums of money, but after A had spent $\frac{1}{5}$ of his money, and B $\frac{1}{10}$ of $\frac{2}{3}$ of his, B had 5d. more than A. How much had each at first?

A had left $1-(\frac{1}{5}$ of $\frac{2}{3})=\frac{13}{15}-\frac{2}{15}=\frac{11}{15}$
B ,, $1-(\frac{1}{10}$ of $\frac{2}{3})=\frac{19}{20}-\frac{1}{15}=\frac{17}{20}$
The diff. between $\frac{11}{15}$ and $\frac{17}{20}$ = 5d.
$\frac{11}{15}-\frac{17}{20}=\frac{112-111}{120}=\frac{1}{120}$
$\frac{1}{120}$ = 5d.
d.
$\therefore$ $\frac{120}{120}=5\times120=600=$ £2 10s. Ans.

FEMALES.

1. Find the cost of 12 acres 1 rood 22 poles at £19 6s. 8d. per acre.

	£	s.	d.			
1 r. $=\frac{1}{4}$ of 1 a.	19	6	8	= Cost of 1 acre.		
			12			
	232	0	0	=	,,	12 acres.
20 p. $=\frac{1}{2}$ of 1 r.	4	16	8	=	,,	1 rood.
2 p. $=\frac{1}{10}$ of 20 p.	2	8	4	=	,,	20 poles.
	0	4	10	=	,,	2 ,,
	£239	9	10			

= cost of 12 a. 1 r. 22 p. Ans.

2. What is the length of the longest tape measure which can be used so as to exactly measure two walls of 2,916 ft. and 3,582 ft. long respectively.

Measure required = G.C.M. of 2916 and 3582.

2916)3582(1
2916
666)2916(
etc., etc.
G.C.M. = 18.
$\therefore$ Measure req. = 18 ft. or 6 yds. Ans.

3. Make out the following bill and properly receipt it:—

3 lbs. of tea at 3s. 4d. per lb.
$4\frac{1}{2}$,, sugar at $5\frac{1}{2}$d. per lb.
$6\frac{1}{2}$,, butter at 1s. 2d. per lb.
$3\frac{1}{2}$,, cheese at $9\frac{1}{2}$d. per lb.
2 ,, currants at $4\frac{1}{2}$ per lb.
6 ,, raisins at $5\frac{1}{2}$d. per lb.

Clifton, July 26th, 1884.

Mrs. Templeton.
Bought of R. SANGER AND CO.

		£	s.	d.
3 lbs. of tea at 3s. 4d. per lb.		0	10	0
$4\frac{1}{2}$,, sugar at $5\frac{1}{2}$d. per lb.		0	2	$0\frac{3}{4}$
$6\frac{1}{2}$,, butter at 1s. 2d. per lb.		0	7	7
$3\frac{1}{2}$,, cheese at $9\frac{1}{2}$d. per lb.		0	2	$9\frac{1}{4}$
2 ,, currants at $4\frac{1}{2}$d. per lb.		0	0	9
6 ,, raisins at $5\frac{1}{2}$d. per lb.		0	2	9
		£1	5	11

Received same time,
R. SANGER AND CO.

4. Add together $6\frac{3}{10}$, $3\frac{3}{4}$, $1\frac{11}{12}$, and $\frac{1}{21}$.

$6\frac{3}{10}+3\frac{3}{4}+1\frac{11}{12}+\frac{1}{21}$
$=10\frac{35+63+66+76}{84}$
$=10\frac{240}{84}$
$=12\frac{2}{7}$. Ans.

Grammar.

MALES AND FEMALES.

1. Parse and analyse the following :—

'And now a gallant tomb they raise
With costly sculptures decked ;
And marbles storied with his praise
Poor Gelert's bones protect.'—SPENSER.

2. Distinguish between an 'inflexion' and a 'suffix,' illustrating your answer from the lines above.

1. *And*—cop. conj., joining the sent. 'They raise a gallant tomb' to preceding sentence.
now—adv. of time, qualifying *raise.*
a—dist. adj., limiting *tomb.*
gallant—adj. of quality, qualifying *tomb.*
tomb—com. noun, sing., neut , obj., gov. by *raise.*
they—pers. pron., com., 3rd, plur., nom. to *raise.*
raise—verb, reg. trans., act., ind., pres., 3rd, plur., agreeing with its nom. *they.*
with—prep., showing relation between *sculptures* and *decked.*
costly—adj. of quality, qualifying *sculptures.*
sculptures—com. noun, neut., plur., obj., gov. by *with.*
decked—past participle of trans. verb *to deck*, used as adj., qualifying *tomb.*
and—cop. conj., joining the sents 'They raise a gallant tomb' and 'marbles protect.'
marbles—com. noun, neut., plur., nom. to *protect.*
storied—adj. of quality, qualifying *marbles.*
with—prep., showing relation between *praise* and *storied.*
his—pers. pron., masc , 3rd, sing., poss., gov. by *praise.*
praise—abs. noun, neut., sing., obj., gov by *with.*
poor—adj. of quality, qualifying *Gelert.*
Gelert's—prop. noun, masc., sing., poss., gov. by *bones.*
bones—com. noun, neut., plur., obj., gov. by *protect.*
protect—verb, reg. trans., act., ind., pres., 3rd, plur., agreeing with its nom. *marbles.*

Sentence.	Kind of Sent.	Connective.	Subject.	Predicate.	Object.	Extension.
(*a*) And now a gallant tomb they raise, with costly sculptures decked ;	Princ. sen.	and	they	raise	a gallant tomb decked with costly sculptures.	now (time)
(*b*) And marbles storied with his praise poor Gelert's bones protect.	Princ. sen. co-ord. with (*a*)	and	marbles storied with his praise	protect	poor Gelert's bones.	

2. An *inflexion* is a change in the form of a word to express a change in the meaning or use of the word, as : *sculptures*, the *s* of which is an inflexion denoting the plural number, and *Gelert's*, the *'s* of which is an inflexion denoting the possessive case. A *suffix* is a syllable added to a root, by means of which we change one part of speech into another, as : *-ant* in the word *gallant*, from the root *gala*, and *-ly* in *costly.*

3. Explain the apostrophe in 'Gelert's.' Write down the possessive case plural number of 'woman,' 'ox,' 'mouse,' 'child,' and 'son-in-law.'

The apostrophe (') used to denote the possessive case, stands instead of the vowel in the syllable *es*, which formerly denoted that case.

Singular.	*Plural.*	*Poss. Plural.*
Woman	women	women's.
Ox	oxen	oxen's.
Mouse	mice	mice's.
Child	children	children's.
Son-in-law	sons-in-law	sons-in-law's.

4. When a singular noun ends in an 's' sound, how is the possessive sign affected ? Give examples.

To avoid the repetition of the sibilant sound, the *s* after the apostrophe is omitted, as—for conscience' sake ; Moses' rod ; Felix' room.

Geography.

(*Answer two Questions.*)

1. Draw a map of the coast line from Dungeness to the Lizard Point, naming the capes and inlets.

2. Give an account of British Columbia ? What are its chief productions ?

British Columbia is that part of B. N. America bordering on the Pacific, and has an area twice that of Great Britain. Its eastern side is mountainous, the Rocky Mts. running the entire length, while the Cascade Mts. run parallel with and near to the coast. Through an opening in this range flows the Frazer, the largest river of the colony. British Columbia has great diversity of soil and climate, the mean temperature being like that of Great Britain. The capital of the colony is New Westminster on the Frazer river. Other towns are Hope, Alexandria, and Yale. It became a separate colony in 1858. The chief productions are minerals—as gold, silver, copper, platinum, coal, iron, and marble ; vegetable—as corn, different kinds of timber, pine, fir, oak, ash, cedar, and maple, being found in abundance ; animal—as furs and fish.

3. Describe the mountain system of Australia.

The mountains of Australia lie chiefly in the S.E. of the continent, and near the coast. The chief range is known by different names, as, the Australian Alps, the Blue Mountains, and the Liverpool Range. The highest peak of the range is Mt. Kosciusko, in the Australian Alps, 7300 feet high. The mountains are much less elevated as they near the north, and in the south of Queensland the range divides, one branch ending in Cape Melville and the other at the Gulf of Carpentaria. In Victoria, in addition to this principal range, are the Pyrenees and Grampians, rising to a height of 4500 feet. In Western Australia there are no heights above 1000 feet. S. Australia has ranges of hills known as the Flinders, Ashburton and Macdonald ranges.

History.

1. Name the principal tribes of Britons, and tell what parts of the country they occupied at the time of Cæsar's invasion.

The principal British tribes at the time of the Roman invasion were the *Cantii*, occupying Kent ; the *Trinobantes*, occupying Middlesex and Essex ; the *Cenimagni* or *Iceni*, who covered Norfolk, Suffolk, and Cambridgeshire ; the *Segontiaci*, in Hants and Berks ; and the *Ancolites* and *Bibroci*, in Berks and Wilts.

2. 'Hardship and sorrow !' exclaimed Alfred the Great ; 'not a king but would wish to be without these if he could. But I know that he cannot.' Illustrate this truth from Alfred's history.

Alfred's whole career showed the truth of his statement. While still a youth he was called to fight against the Danes, and at twenty he shared in the victory gained over them at Ashdune, in Berkshire. For seven years after his accession to the throne he fought against them, ultimately being driven from the throne. In 876 he made peace with them, which they, however, immediately broke and seized Exeter. He was successful in 877, but was again defeated in the following year, finally overthrowing the Danes under Guthrum in 879. In 893 a new invasion of the Danes under Hastings took place, and they were not finally repulsed till 897. Besides troubles with the Danes, Alfred was considerably annoyed by his own people. In repressing the crime and promoting order and regularity in his kingdom, he often met with disappointment, and laid himself open to accusations of sternness and cruelty.

3. What was the character of the Danes at the beginning of the eleventh century ? Describe their ships, and explain why they so often got the better of the Saxons.

The Danes at the beginning of the eleventh century were brave and adventurous. The throne of England was occupied by Ethelred the Unready, who was surrounded by traitors of every kind. Neither his forces nor his officers could be depended upon, for on several occasions the latter gave warning to the Danes when they were in danger of being attacked. After the massacre of Danes in 1002, good and bad, the old settlers as well as new comers being all slain, a large fleet, manned only by Danish freemen, came to this country. Their ships were lofty, with high prows on which were figures of lions, bulls, dragons, etc., and their sides were painted with bright colours, shields of burnished steel being hung from stem to stern and glittering in the

sun. At the masthead each ship carried a figure of an eagle or other bird with outstretched wings, and banners embroidered with gold and silver were profusely displayed. The skill of the sailors, the superiority of the ships, and the cowardice or treachery of the English gave the Danes the victory.

Composition.

Write from memory the substance of the passage read to you by the Inspector. The passage was as follows :—

A Cashmere merchant came to Cabul with some handsome shawls, and deposited them with a merchant there. Upon demanding his shawls a few days after, he was met by the Cabul merchant with a flat denial of having ever received them. He appealed to the Ameer, who directed him to repair at a certain hour next day to the shop of the Cabul merchant. Next day the Ameer proceeded in great state to the shop. When he was opposite to it, recognising the Cashmere merchant, he expressed great pleasure at seeing him, and invited him to his palace. A few hours afterwards the Cabul merchant appeared to implore pardon of the friend of the Ameer, not only restoring the shawls, but forcing upon him a large sum of money along with them.

Needlework.

FEMALES.

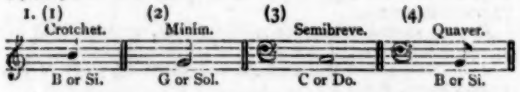
One hour will be allowed for this exercise in the afternoon.

Music.

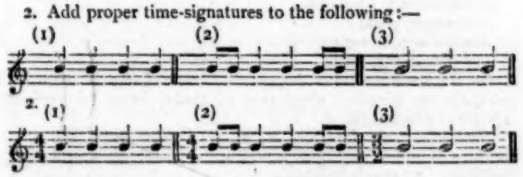
A quarter of an hour allowed for this paper.

(N.B.—Pupil Teachers may answer the questions in either the Staff Notation or the Tonic Sol-fa, but *not both*. The questions in the Tonic Sol-fa Notation will be found at the end.)

1. Write above each of the following notes its value-name (semibreve, &c.), and below each its pitch-name (C, D, or Do, Si, &c.) :—



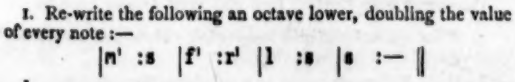
2. Add proper time-signatures to the following :—



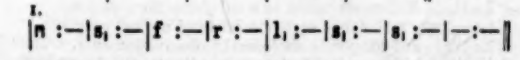
3. Write below each of the following intervals its name (major fourth, &c.) :—

TONIC SOL-FA NOTATION.

1. Re-write the following an octave lower, doubling the value of every note :—



1.



2. What does "Key A," or "Key B," mean at the beginning of a tune?

2. That the particular sound called A or B is to be the tonic, and called *doh*.

3. Write the names of the following intervals :—(1) *soh* to *te* ; (2) *te* to *doh*^{1} ; (3) *me* to *soh* ; (4) *te*, to *fah*.

3. (1) Major 3rd ; (2) Minor 2nd ; (3) Minor 3rd ; (4) Minor or Imperfect 5th.

SECOND YEAR.

Pupil Teachers at end of Second Year.

FIRST PAPER.

Three hours and a half allowed.

Euclid.

MALES.

[All generally understood abbreviations for *words* may be used.]

1. To draw a straight line at right angles to a given straight line, from a given point in the same.

State and prove the corollary. Is the proof quite sound?

Euclid, Book I., Prop. 11.

The proof of the corollary is objectionable, for in order to erect the perpendicular by the aid of the proposition, the line AB must be produced, and it has to be assumed that it can only be produced in one way, for if it could be produced in two ways as ABC, ABD, then there would be two perpendiculars. The proof is therefore not quite sound.

2. Any two sides of a triangle are together greater than the third side.

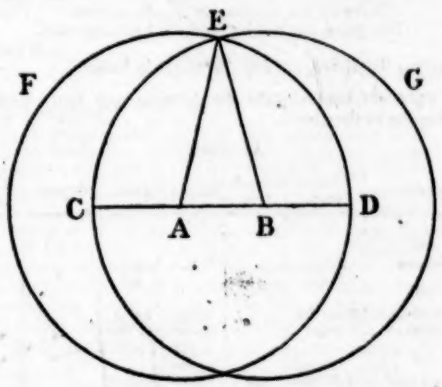
Euclid, Book I., Prop. 20.

3. On a given line describe an isosceles triangle each of whose equal sides shall be double of the base.

Let AB be the given straight line.

It is required to describe on AB an isosceles triangle, each of whose sides shall be double AB.

Produce AB both ways to C and D. Make AC, BD each =AB.



From centre A at distance AD describe circle DEF, and from centre B at distance BC describe circle CEG (Post. 3)

From point E, where circles cut each other, draw EA, EB to points A and B. Then AEB is the Δ required.

∵ A is centre of circle DEF, AE=AD (Def. 15).
∵ B is centre of circle CED, BC=BE (Def. 15).
But AD is double of AB, for BD=AB.
And BC is double of AB, for AC=AB.
And doubles of equal things are equal (Ax. 6) ;
∴ BC=AD. And BE=BC, and AE=AD.
∴ AE and BE are also each double of AB.

Therefore a Δ AEB has been drawn on a given line, AB, having each of its sides AE, BE double of the base.—Q. E. F.

Arithmetic.

FEMALES.

1. Express $\frac{5}{6}$ of $\frac{11}{15}$ of $\frac{3}{7}+\frac{5}{8}\div\frac{3}{4}-\frac{1}{10}$ of $31\frac{1}{2}$ as a vulgar fraction in its simplest form.

$$\begin{aligned}
&\tfrac{5}{6}\text{ of }\tfrac{11}{15}\text{ of }\tfrac{3}{7}+\tfrac{5}{8}\div\tfrac{3}{4}-\tfrac{1}{10}\text{ of }31\tfrac{1}{2}\\
&=\tfrac{5}{6}\times\tfrac{11}{15}\times\tfrac{1}{7}+\tfrac{5}{8}\times\tfrac{4}{3}-\tfrac{1}{10}\times\tfrac{21}{2}\\
&=\tfrac{55}{126}+\tfrac{5}{6}-\tfrac{21}{20}\\
&=\frac{275+672-436}{420}\\
&=\tfrac{511}{420}\\
&=1\tfrac{91}{420}.\quad\text{Ans.}
\end{aligned}$$

2 Add together $\frac{3}{4}$ of £1, $\frac{1}{5}$ of a florin, $\frac{2}{3}$ of 1s., and $\frac{1}{2}$ of $\frac{1}{4}$ of 13s 4d. ; and subtract the result from $\frac{4}{15}$ of £10.

Grammar.

MALES AND FEMALES.

1. Parse and analyse the following :—

'And now a gallant tomb they raise
With costly sculptures decked ;
And marbles storied with his praise
Poor Gelert's bones protect.'—SPENSER.

2. Distinguish between an 'inflexion' and a 'suffix,' illustrating your answer from the lines above.

1. *And*—cop. conj., joining the sent. 'They raise a gallant tomb' to preceding sentence.
now—adv. of time, qualifying *raise.*
a—dist. adj., limiting *tomb.*
gallant—adj. of quality, qualifying *tomb.*
tomb—com. noun, sing., neut , obj., gov. by *raise.*
they—pers. pron., com., 3rd, plur., nom. to *raise.*
raise—verb, reg. trans., act., ind., pres., 3rd, plur., agreeing with its nom. *they.*
with—prep., showing relation between *sculptures* and *decked.*
costly—adj. of quality, qualifying *sculptures.*
sculptures—com. noun, neut., plur., obj., gov. by *with.*
decked—past participle of trans. verb *to deck*, used as adj., qualifying *tomb.*
and—cop. conj., joining the sents 'They raise a gallant tomb' and 'marbles protect.'
marbles—com. noun, neut., plur., nom. to *protect.*
storied—adj. of quality, qualifying *marbles.*
with—prep., showing relation between *praise* and *storied.*
his—pers. pron., masc , 3rd, sing., poss., gov. by *praise.*
praise—abs. noun, neut., sing., obj., gov by *with.*
poor—adj. of quality, qualifying *Gelert.*
Gelert's—prop. noun, masc., sing., poss., gov. by *bones.*
bones—com. noun, neut., plur., obj., gov. by *protect.*
protect—verb, reg. trans., act., ind., pres., 3rd, plur., agreeing with its nom. *marbles.*

Sentence.	Kind of Sent.	Connective.	Subject.	Predicate.	Object.	Extension.
(*a*) And now a gallant tomb they raise, with costly sculptures decked ;	Princ. sen.	and	they	raise	a gallant tomb decked with costly sculptures.	now (time)
(*b*) And marbles storied with his praise poor Gelert's bones protect.	Princ. sen. co-ord. with (*a*)	and	marbles storied with his praise	protect	poor Gelert's bones.	

2. An *inflexion* is a change in the form of a word to express a change in the meaning or use of the word, as : *sculptures*, the *s* of which is an inflexion denoting the plural number, and *Gelert's*, the '*s* of which is an inflexion denoting the possessive case. A *suffix* is a syllable added to a root, by means of which we change one part of speech into another, as : *-ant* in the word *gallant*, from the root *gala*, and *-ly* in *costly.*

3. Explain the apostrophe in 'Gelert's.' Write down the possessive case plural number of 'woman,' 'ox,' 'mouse,' 'child,' and 'son-in-law.'

The apostrophe (') used to denote the possessive case, stands instead of the vowel in the syllable *es*, which formerly denoted that case.

Singular.	*Plural.*	*Poss. Plural.*
Woman	women	women's.
Ox	oxen	oxen's.
Mouse	mice	mice's.
Child	children	children's.
Son-in-law	sons-in-law	sons-in-law's.

4. When a singular noun ends in an 's' sound, how is the possessive sign affected ? Give examples.

To avoid the repetition of the sibilant sound, the *s* after the apostrophe is omitted, as—for conscience' sake ; Moses' rod ; Felix' room.

Geography.

(*Answer two Questions.*)

1. Draw a map of the coast line from Dungeness to the Lizard Point, naming the capes and inlets.

2. Give an account of British Columbia ? What are its chief productions ?

British Columbia is that part of B. N. America bordering on the Pacific, and has an area twice that of Great Britain. Its eastern side is mountainous, the Rocky Mts. running the entire length, while the Cascade Mts. run parallel with and near to the coast. Through an opening in this range flows the Frazer, the largest river of the colony. British Columbia has great diversity of soil and climate, the mean temperature being like that of Great Britain. The capital of the colony is New Westminster on the Frazer river. Other towns are Hope, Alexandria, and Yale. It became a separate colony in 1858. The chief productions are minerals—as gold, silver, copper, platinum, coal, iron, and marble ; vegetable—as corn, different kinds of timber, pine, fir, oak, ash, cedar, and maple, being found in abundance ; animal—as furs and fish.

3. Describe the mountain system of Australia.

The mountains of Australia lie chiefly in the S.E. of the continent, and near the coast. The chief range is known by different names, as, the Australian Alps, the Blue Mountains, and the Liverpool Range. The highest peak of the range is Mt. Kosciusko, in the Australian Alps, 7300 feet high. The mountains are much less elevated as they near the north, and in the south of Queensland the range divides, one branch ending in Cape Melville and the other at the Gulf of Carpentaria. In Victoria, in addition to this principal range, are the Pyrenees and Grampians, rising to a height of 4500 feet. In Western Australia there are no heights above 1000 feet. S. Australia has ranges of hills known as the Flinders, Ashburton and Macdonald ranges.

History.

1. Name the principal tribes of Britons, and tell what parts of the country they occupied at the time of Cæsar's invasion.

The principal British tribes at the time of the Roman invasion were the *Cantii*, occupying Kent ; the *Trinobantes*, occupying Middlesex and Essex ; the *Cenimagni* or *Iceni*, who covered Norfolk, Suffolk, and Cambridgeshire ; the *Segontiaci*, in Hants and Berks ; and the *Ancolites* and *Bibroci*, in Berks and Wilts.

2. 'Hardship and sorrow !' exclaimed Alfred the Great ; 'not a king but would wish to be without these if he could. But I know that he cannot.' Illustrate this truth from Alfred's history.

Alfred's whole career showed the truth of his statement. While still a youth he was called to fight against the Danes, and at twenty he shared in the victory gained over them at Ashdune, in Berkshire. For seven years after his accession to the throne he fought against them, ultimately being driven from the throne. In 876 he made peace with them, which they, however, immediately broke and seized Exeter. He was successful in 877, but was again defeated in the following year, finally overthrowing the Danes under Guthrum in 879. In 893 a new invasion of the Danes under Hastings took place, and they were not finally repulsed till 897. Besides troubles with the Danes, Alfred was considerably annoyed by his own people. In repressing the crime and promoting order and regularity in his kingdom, he often met with disappointment, and laid himself open to accusations of sternness and cruelty.

3. What was the character of the Danes at the beginning of the eleventh century ? Describe their ships, and explain why they so often got the better of the Saxons.

The Danes at the beginning of the eleventh century were brave and adventurous. The throne of England was occupied by Ethelred the Unready, who was surrounded by traitors of every kind. Neither his forces nor his officers could be depended upon, for on several occasions the latter gave warning to the Danes when they were in danger of being attacked. After the massacre of Danes in 1002, good and bad, the old settlers as well as new comers being all slain, a large fleet, manned only by Danish freemen, came to this country. Their ships were lofty, with high prows on which were figures of lions, bulls, dragons, etc., and their sides were painted with bright colours, shields of burnished steel being hung from stem to stern and glittering in the

sun. At the masthead each ship carried a figure of an eagle or other bird with outstretched wings, and banners embroidered with gold and silver were profusely displayed. The skill of the sailors, the superiority of the ships, and the cowardice or treachery of the English gave the Danes the victory.

Composition.

Write from memory the substance of the passage read to you by the Inspector. The passage was as follows :—

A Cashmere merchant came to Cabul with some handsome shawls, and deposited them with a merchant there. Upon demanding his shawls a few days after, he was met by the Cabul merchant with a flat denial of having ever received them. He appealed to the Ameer, who directed him to repair at a certain hour next day to the shop of the Cabul merchant. Next day the Ameer proceeded in great state to the shop. When he was opposite to it, recognising the Cashmere merchant, he expressed great pleasure at seeing him, and invited him to his palace. A few hours afterwards the Cabul merchant appeared to implore pardon of the friend of the Ameer, not only restoring the shawls, but forcing upon him a large sum of money along with them.

Needlework.

FEMALES.

One hour will be allowed for this exercise in the afternoon.

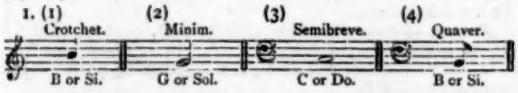
Music.

A quarter of an hour allowed for this paper.

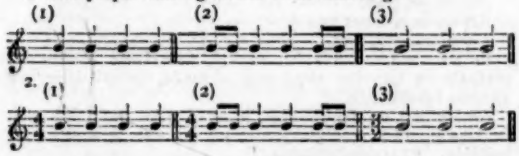
(N.B.—Pupil Teachers may answer the questions in either the Staff Notation or the Tonic Sol-fa, but *not both*. The questions in the Tonic Sol-fa Notation will be found at the end.)

1. Write above each of the following notes its value-name (semibreve, &c.), and below each its pitch-name (C, D, or Do, Si, &c.) :—

1. (1) Crotchet. (2) Minim. (3) Semibreve. (4) Quaver.

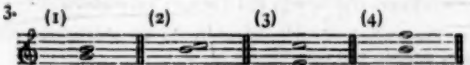


2. Add proper time-signatures to the following :—



3. Write below each of the following intervals its name (major fourth, &c.) :—

3. (1) (2) (3) (4)



TONIC SOL-FA NOTATION.

1. Re-write the following an octave lower, doubling the value of every note :—

$$|n' :s \quad |f' :r' \quad |l \quad :s \quad |s \quad :- \quad \|$$

1.

$$|n :-|s_1 :-|f :-|r :-|l_1 :-|s_1 :-|s_1 :-|-:-\|$$

2. What does "Key A," or "Key B," mean at the beginning of a tune?

2. That the particular sound called A or B is to be the tonic, and called *doh*.

3. Write the names of the following intervals :—(1) *soh* to *te*; (2) *te* to *doh'*; (3) *me* to *soh*; (4) *te*, to *fah*.

3. (1) Major 3rd; (2) Minor 2nd; (3) Minor 3rd; (4) Minor or Imperfect 5th.

SECOND YEAR.

Pupil Teachers at end of Second Year.

FIRST PAPER.

Three hours and a half allowed.

Euclid.

MALES.

[All generally understood abbreviations for *words* may be used.]

1. To draw a straight line at right angles to a given straight line, from a given point in the same.

State and prove the corollary. Is the proof quite sound?

Euclid, Book I., Prop. 11.

The proof of the corollary is objectionable, for in order to erect the perpendicular by the aid of the proposition, the line AB must be produced, and it has to be assumed that it can only be produced in one way, for if it could be produced in two ways as ABC, ABD, then there would be two perpendiculars. The proof is therefore not quite sound.

2. Any two sides of a triangle are together greater than the third side.

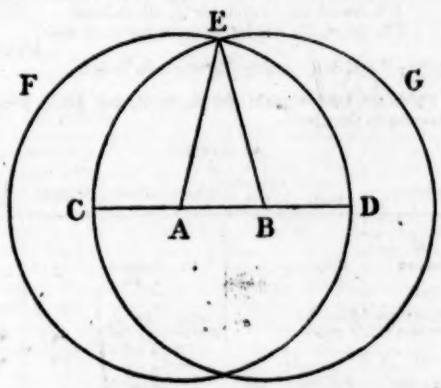
Euclid, Book I., Prop. 20.

3. On a given line describe an isosceles triangle each of whose equal sides shall be double of the base.

Let AB be the given straight line.

It is required to describe on AB an isosceles triangle, each of whose sides shall be double AB.

Produce AB both ways to C and D. Make AC, BD each =AB.



From centre A at distance AD describe circle DEF, and from centre B at distance BC describe circle CEG (Post. 3)

From point E, where circles cut each other, draw EA, EB to points A and B. Then AEB is the △ required.

∵ A is centre of circle DEF, AE=AD (Def. 15).
∵ B is centre of circle CED, BC=BE (Def. 15).
But AD is double of AB, for BD=AB.
And BC is double of AB, for AC=AB.
And doubles of equal things are equal (Ax. 6);
∴ BC=AD. And BE=BC, and AE=AD.
∴ AE and BE are also each double of AB.

Therefore a △ AEB has been drawn on a given line, AB, having each of its sides AE, BE double of the base.—Q. E. F.

Arithmetic.

FEMALES.

1. Express $\frac{3}{4}$ of $\frac{1}{3}$ of $\frac{2}{7}+\frac{3}{5}\div\frac{1}{4}-\frac{1}{10}$ of $31\frac{1}{2}$ as a vulgar fraction in its simplest form.

$$\begin{aligned}
&\tfrac{3}{4} \text{ of } \tfrac{1}{3} \text{ of } \tfrac{2}{7}+\tfrac{3}{5}\div\tfrac{1}{4}-\tfrac{1}{10} \text{ of } 31\tfrac{1}{2}\\
&=\tfrac{3}{4}\times\tfrac{1}{3}\times\tfrac{2}{7}+\tfrac{3}{5}\times\tfrac{4}{1}-\tfrac{1}{10}\times\tfrac{63}{2}\\
&=\tfrac{6}{84}+\tfrac{12}{5}-\tfrac{63}{20}\\
&=\frac{275+672-436}{420}\\
&=\tfrac{511}{420}\\
&=1\tfrac{91}{420}. \quad \text{Ans.}
\end{aligned}$$

2 Add together $\frac{3}{4}$ of £1, $\frac{1}{2}$ of a florin, $\frac{2}{3}$ of 1s., and $\frac{1}{2}$ of $\frac{1}{4}$ of 13s 4d.; and subtract the result from $\frac{4}{15}$ of £10.

	s.	d.
$\frac{3}{4}$ of £1 = $\frac{3}{4}$ × 20s. =	15	0
$\frac{1}{4}$ of 2s. = $\frac{1}{4}$ × 24d. =	0	4
$\frac{1}{3}$ of 1s. = $\frac{1}{3}$ × 12d. =	0	8
$\frac{1}{4}$ of $\frac{1}{3}$ of 13s. 4d. = $\frac{1}{4}$ × $\frac{1}{3}$ × 160d. =	1	4
	17	4

$\frac{4}{5}$ of £10 = $\frac{4}{5}$ × £$\frac{240}{21}$ = £1 12 0

£1 12s. 0d. − 17s. 4d. = £0 14 8 Ans.

3. Express $1\frac{7}{75}$ and $\frac{39}{40}$ as decimals.

$1\frac{7}{75} = 1\frac{28}{300} = 1.056$. Ans.

$\frac{39}{40} = \frac{3.9}{4} = .975$. Ans.

4. A man gives away in charity $\frac{1}{4}$ of his income, and pays $\frac{1}{10}$ of it in rates and taxes. With these deductions he has £473 13s. 1d. left; what is his gross income?

$1 - (\frac{1}{4} + \frac{1}{10}) = £473\ 13s.\ 1d.$

$\frac{40 - (5+4)}{40} = £473\ 13s.\ 1d.$

$\frac{31}{40} = £473\ 13s.\ 1d.$

$\frac{1}{40} = \frac{£473\ 13s.\ 1d. \times 40}{31}$

$= £611\ 2s.\ 4d.$ Ans.

Grammar.

MALES AND FEMALES.

1. I cannot see *what* flowers are at my feet;
Nor what soft incense hangs upon the boughs;
But, in *embalmèd* darkness, *guess each sweet*
Wherewith the seasonable month endows
The grass, the *thicket*, and the fruit-tree *wild*.
—KEATS.

Analyse the above, parsing the words in italics.

2. Point out, and explain the force of, any Latin prefix or termination in the above.

1. ANALYSIS.

Sentence.	Kind of Sent.	Connective.	Subject.	Pred.	Object.	Extension.
(*a*)						
I cannot see	Princ. Sent.		I	cannot see		
(*b*)						
what flowers are at my feet	Noun Sen. to (*a*)		what flowers	are at my feet		
(*c*)						
nor can I see	P.S. co-ord. with (*a*)	nor	[I]	[can see]		
(*d*)						
what soft incense hangs upon the boughs	Noun Sen. to (*c*)		what soft incense	hangs		upon the boughs (*place*)
(*e*)						
but, in embalmed darkness, guess each sweet	Prin. Sent. advers. to (*a*) and (*c*)	but	[I]	guess	each sweet	in embalmed darkness (*place*)
(*f*)						
wherewith the seasonable month endows the grass, the thicket, and the fruit-tree wild.	Adj. sent. to (*e*)	wherewith	the seasonable month	endows	the grass, the thicket and the fruit-tree wild	

PARSING.

What—rel. pro., used as adj. of distinction, qual. *flowers*.
nor = and not—cop. conj., joining the sents. 'I cannot see,' and 'I can see.'
but—disj. conj., joining the sents. 'I cannot see,' and 'I guess.'
embalmed—adj. of quality, qual. *darkness*.
guess—reg. trans. verb, act., ind., pres., 1st, sing., agreeing with *I*.
each—distributive adj., limiting *sweet*.
sweet—abs. noun, neut., sing., obj., gov. by *guess*.
wherewith—cop. conj., joining the sents. 'I guess each sweet,' and 'The month endows.'
thicket—com. noun, neut., sing., obj., gov. by *endows*.
wild—adj. of quality, qual. *fruit-tree*.

2. Prefixes:—
In—in incense, meaning *in*.
em—in embalmed, meaning *in* (through French).
en—in endows, meaning *in* (through French.)
Affixes:—
able—in seasonable, having the force of *to make*, seasonable meaning that which happens in due time; *able* is also an English affix.

3. What is the prefix in the following words:—Occupy, pursue, resemble, perish, pardon.

In occupy (L.) *ob*, meaning *in the way of*.
,, pursue (Fr.) *pur*, ,, *for*.
,, resemble (L.) *re*, ,, *again*.
,, perish (L.) *per*, ,, *through, completely*.
,, pardon (Fr.) *par*, ,, *through*.

4. Paraphrase the following:—

'Hail to thee, blythe spirit!
Bird thou never wert,
That from heaven, or near it,
Pourest thy full heart
In profuse strains of unpremeditated art.'
SHELLEY.—*To a Skylark*.

I bid thee hail, joyous spirit! for to me thou ever seemest more than bird, as from the lofty heights so near to heaven, thy o'ercharged breast sends forth such floods of artless melody.

Geography.

(*Answer two Questions.*)

1. Draw a map of Norway and Sweden, and note upon it, and describe the chief towns.

In NORWAY:—*Christiania*, capital of Norway on Christiania Bay, seat of university, largest town, port, and seat of trade. 77,000 inhabitants.
Bergen, second town, shipbuilding, port, exports dried fish. 33,000 inhabitants.
Trondheim, old capital, and present crowning place of Norwegian kings, port.
Frederickshall, fortress.
Stavanger, port.
Konigsburg, silver mines.
Christiansand, port.
In SWEDEN:—*Stockholm*, capital, near Lake Malar, built partially on islands; chief seat of trade, beautiful environs. 170,000 inhabitants.
Gothenburg, on the Cattegat, place of great trade, has manufactures of cotton, machinery, and sugar; also breweries; shipbuilding. 77,000 inhabitants.
Lund, university.
Upsala, university, archbishopric, iron mines near.
Karlskrono, *Helsinburg*, and *Calmar*, fortresses.

2. From which of our possessions do we obtain tea, coffee, sugar, pepper, and cinnamon?
Tea from China, India, Assam.
Coffee from West Indies, East Indies, Arabia, Ceylon, Brazil.
Sugar from West Indies, Mauritius, East Indies.
Pepper from Jamaica, East Indian Islands, and India.
Cinnamon from Ceylon, East and West Indian Islands.

3. What are latitude and longitude? How are they found? and what is their use in navigation?

Latitude is distance north or south from the equator.
Longitude is distance east or west from a given meridian.
Latitude and longitude are found by observation only. To find the latitude, instruments (sextants, quadrants, etc.,) may be used to ascertain the angle which any fixed star makes with the horizon of the observer. In the tables in the *Nautical Almanack*, the position of this star in regard to the Pole is shown. It may then be found by adding this angular distance to the distance from the pole if the star is below the pole, or subtracting if the star is more elevated than the pole, what the latitude of the observer is; *e.g.*, the elevation of a star is found to be 13° 26′, and from the star to the pole is 15° 14′. ∴ Lat. = 28° 40′.

Longitude is found by ascertaining the difference of time between its noon, and that of a place under any selected meridian. Noon at any place is ascertained by watching the precise moment of the sun reaching the meridian. The time at Greenwich is known by means of the chronometer. As a difference of time of 4′ means a difference of 1°, the long. may be easily calculated. Other means than the use of a chronometer are (*a*) The telegraph; (*b*) Certain phenomena mentioned in *Nautical Almanack;* (*c*) The motion of the moon among the stars.

By means of latitude and longitude sailors tell their exact position at any given time, and so are able to find their way across the trackless sea in safety.

SECOND PAPER.

Two hours and a half allowed.

Needlework.

FEMALES.

The needlework specimens will be collected by the Inspector at the expiration of one hour after the distribution of the examination paper.

Arithmetic.

MALES.

1. If a man has £11,500 stock in the 3 per cents., what would he get for it by selling out at 101⅛, the broker charging 2s. 6d. per cent.?

For every £100 stock of £11,500 he will get
$(£101\frac{1}{8} - \frac{1}{8}) = £101$.
∴ He will get $£101 \times 115 = £11{,}643\ 15s.$ Ans.

2 If the average cost of 20 oxen was £15 19s. 6d., and 8 cost £15 each, and 7 cost £16 each, what was the average cost of the remainder?

	£	s.	d.
20 at £15 19s. 6d. =	319	10	0
8 at £15 =	£120		
7 at £16 =	£112		
∴ 15 cost	232	0	0
and 5 cost	87	10	0

∴ Average of these 5 = £17 10s. 6d. Ans.

3. In what time will £6251 17s. 6d. amount to £7127 2s. 9d. at 3½ per cent. per annum, simple interest?

Total interest = £7127 2s. 9d. − £6251 17s. 6d. = £875 5s. 3d.

Int. for 1 year $= \frac{£6251\ 17s.\ 6d. \times 3\frac{1}{2}}{100} = £218\ 16s.\ 3\frac{1}{2}d.$

∴ No. of years $= \frac{£875\ 5s.\ 3d.}{£218\ 16s.\ 3\frac{1}{2}d.} = 4$ years. Ans.

4. Find a man's daily wages if a reduction of 3d. per day reduces his wages 6 per cent.

6 in every 100 = 3d.
1 „ „ $= \frac{3}{6}$
100 „ „ $= \frac{3 \times 100}{6}$
$= 50d. = 4s.\ 2d.$ Ans.

History.

MALES AND FEMALES.

1. Write a short life of William I. and his consort,

William I. was the son of Robert, Duke of Normandy. He was born in 1027, and became duke in 1036. He married Matilda, daughter of Baldwin V., Count of Flanders, and by her had four sons and several daughters. He quelled all the rebellions against him in his own dukedom, got the promise of the crown of England from Edward the Confessor, and when Harold was crowned, in spite of the oath he had made to William to help the latter to the throne, he invaded England in 1066, and gained the battle of Senlac and marched to London, where he was crowned on Christmas Day of the same year. He gave the lands to his Norman followers, established the Feudal System, and built castles in different places so that his power might be maintained in the country. His government was harsh and cruel, as seen in the laying waste of the district for the New Forest, and that of the valley of York. To facilitate his government he had Domesday book compiled. After a reign of 21 years he died from injuries received at Mantes, and was buried at Rouen, 1087.

2. What was the extent of Henry II.'s dominions? Explain how they came to be so extensive?

Henry II. received from his father Anjou, Touraine, and Maine; he derived from his mother the Province of Normandy, and he received as his wife's dower Guienne, Poictou, Xaintogne, Auvergne, Perigord, Angoumois, and Limousin; he claimed and succeeded in getting Nantes, Toulouse, and Brittany. He succeeded Stephen in the throne of England, and added Wales and Ireland to his already extensive dominions by conquest.

3. Edward III. claimed a continental throne; what were the grounds of his claim, and what efforts did he make to enforce it?

Edward III. claimed the throne of France, the help which the king of France gave the Scots being the first provocation to urge him to make that claim. This claim was founded on his descent from Philip, but was utterly untenable as he was debarred from the throne by the Salic law, and even if it had not been in existence there were other claimants to the throne, descendants of older branches of the family of Philip, who had a prior claim.

To gain the throne, Edward fought the naval battle of Sluys (1340), the land battle of Crecy (1346), besieged Calais (1346-7), and fought the battle of Poictiers in 1356. Heafterwards gave up his claim to the crown of France, but was invested with Poictou and other southern provinces, and Guienne, free from all homage to the French king. The war, however, was renewed in 1369, and after the Black Prince's death Edward lost nearly the whole of his possessions in France, except Calais, Bayonne, and Bordeaux.

Teaching.

How would you comment upon the following reading lesson to an upper class?

He therefore got a number of light, active, wiry mountaineers from the Pyrenees—men used to scrambling up precipices, and possessed of steady heads and sure feet—and with these he attacked the forests and rocks of Snowdon so successfully, that he drove Llewelyn from their shelter towards the Wye.

Draw attention to the skill displayed in selecting the best men possible for the work the king had to do—mountaineers being best able to fight among the mountains. Elicit or explain, if necessary, the meaning of wiry; show similarity of districts—Pyrenees and Welsh mountains; show how the constant contact with rough, dangerous places gives quickness of eye, coolness of nerve, and sureness of foot.

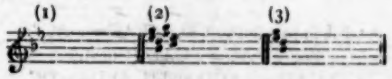
Music.

A quarter of an hour allowed for this paper.

(N.B.—Pupil Teachers may answer the questions in either the Staff Notation or the Tonic Sol-fa, but *not both*. The questions in the Tonic Sol-fa Notation will be found at the end.)

1. Write the key-signatures of each of the following major keys:—(1) of B♭; (2) of E; (3) of D.

1. (1) (2) (3)

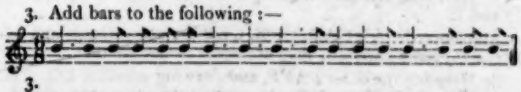


2. Write below each of the following intervals its name (major third, &c.):—

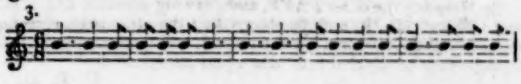
2. (1) (2) (3)

Augmented or Pluperfect 4th. Major or Perfect 5th. Major or Perfect 5th.

3. Add bars to the following:—



3.



TONIC SOL-FA NOTATION.

1. What is the mental effect of (1) *te*; and of (2) *doh*; and of (3) *lah*?

1. (1) Keen, expectant; (2) repose, firm; (3) sad.

2. Write the names of the following intervals:—(1) *fah* to *ray*; (2) *me* to *doh*^{1}; (3) *lah*$_1$ to *soh*.

2. (1) Major 6th; (2) Minor 6th; (3) Minor 7th.

3. Write (1) a six-pulse measure; (2) a four-pulse measure; (3) a two-pulse measure.

3. (1) | : : | : : ‖ (2) | : | : ‖ (3) | : ‖

THIRD YEAR.

Pupil Teachers at end of Third Year.

FIRST PAPER.

Three hours and a half allowed.

Euclid.

MALES.

[All generally understood abbreviations for *words* may be used.]

Answer two Questions, including No. 3, if you can.

1. The opposite sides and angles of a parallelogram are equal to one another, and the diameter bisects it, that is, divides it into two equal parts.

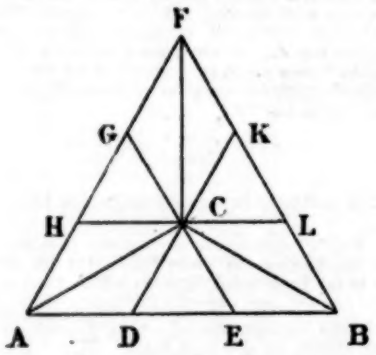
Euclid, Book I., Prop. 34.

2. In any right-angled triangle, the square which is described upon the side subtending the right angle is equal to the squares described upon the sides which contain the right angle.

Euclid, Book I., Prop. 47.

3. Trisect a given line: and hence divide an equilateral triangle into nine equal parts.

Let AB be the given line. Upon AB describe equilateral △ AFB. Bisect ∠'s FAB, FBA by lines meeting in C. Through C draw CD parallel to AF, and CE parallel to FB. AB is divided into three parts at points D and E.



∵ FA is parallel to CD, ∠ FAC = ∠ ACD.
But ∠ FAC = ∠ CAD (Const.)
∴ ∠ CAD = ∠ ACD and (I. 6) DA = DC.
Again: ∠ FAB = ∠ CDE, and ∠ CED = ∠ FBA.
∴ ∠ DCE = ∠ AFB (I. 32).
And DC = DE.
But DC = DA. ∴ DA = DE.

In the same way it may be shown that EC = ED.

∴ AD, DE, EB are = to one another, and AB is trisected in D and E.

And since the △'s CAD, CDE, CEB are upon = bases and between the same parallels, they are equal to one another.

By bisecting the other ∠ AFB, and drawing parallels CG, CH, and CK and CL, it may be shown that the other sides may be trisected, and that the △'s are all equal, and thus an equilateral triangle may be divided into nine equal triangles.

Q. E. D.

Algebra.

(Answer two Questions, including No. 3, if you can.)

1. Find the G.C.M. of

$$2a^3 - 11a^2 - 9 \text{ and } 7(4a^3 + 11a^2 + 81).$$

$$2a^3 - 11a^2 - 9 \Big) 4a^3 + 11a^2 + 81 \Big(2$$
$$4a^3 - 22a^2 - 18$$
$$11) 11a^2 + 22a + 99$$
$$a^2 + 2a + 9 \Big) 2a^3 - 11a^2 - 9 \Big(2a$$
$$2a^3 + 4a^2 + 18a$$
$$- 4a^2 - 11a - 18a - 9 \Big) a^2 + 2a + 9 \Big(-1$$
$$4a^3 + 11a^2 + 18a + 9 \Big) 4a^3 + 8a^2 + 36 \Big(a - 11$$
$$4a^3 + 11a^2 + 18a + 9a$$
$$- 11a^2 - 18a - 9a$$
$$- 44a^3 - 72a^2 - 36a$$
$$- 44a^3 - 121a^2 - 198a - 99$$
$$81) 81a^2 + 162a + 243$$
$$a^2 + 2a + 3 \Big) 4a^3 + 11a^2 + 18a + 9 \Big(4a + 3$$
$$4a^3 + 8a^2 + 12a$$
$$3a^2 + 6a + 9$$
$$3a^2 + 6a + 9$$

G. C. M. $= a^2 + 2a + 3$. Ans.

2. Simplify $\frac{x^4 - y^4}{x^2 - 2xy + y^2} \times \frac{x - y}{x^2 + yx}$.

$$\frac{x^4 - y^4}{x^2 - 2xy + y^2} \times \frac{x - y}{x^2 + yx}$$
$$= \frac{(x^2 + y^2)(x^2 - y^2)(x - y)}{(x - y)(x - y)(x^2 + yx)}$$
$$= \frac{(x^2 + y^2)(x^2 - y^2)}{(x - y)(x + y)x}$$
$$= \frac{x^2 + y^2}{x}$$
$$= x + \frac{y^2}{x}. \quad \text{Ans.}$$

3. Any quantity may be transposed from one side of an equation to the other side by changing its sign.

Solve (1) $\frac{7x + 9}{4} - \left(x - \frac{2x - 1}{9} \right) - 7 = 0.$

(2) $\frac{1}{x - 6} - \frac{1}{x - 8} = \frac{1}{x - 2} - \frac{1}{x - 4}.$

Let $x^3 + y^3 + 6 = 3x^3 + 11$ represent any equation.

Any quantity may be transposed from one side of the equation to the other side by changing its sign. For let $+6$ be the quantity to be transposed: then take $+6$ away from each side, and the equation will be

$$x^2+y^2+6-6=3x^3+11-6$$
$$\text{or, } x^2+y^2=3x^3+11-6$$

i.e., $+6$ has been transposed by changing its sign.

Again: let $3x^3$ be the quantity to be transposed, then take $3x^3$ from each side and the equation will stand thus—

$$x^3+y^2+6-3x^3=3x^3-3x^3+11$$
$$\text{or, } x^3+y^2+6-3x^3=11.$$

i.e., $3x^3$ has been transposed by changing its sign.

(1) $\frac{7x+9}{4}-\left(x-\frac{2x-1}{9}\right)-7=0$

$=\frac{7x+9}{4}-\frac{7x+1}{9}-7=0$

$=63x+81-28x-4-252=0$

$=35x=175$

$=x=5$. Ans.

(2) $\frac{1}{x-6}-\frac{1}{x-8}=\frac{1}{x-2}-\frac{1}{x-4}$

$\frac{(x-8)-(x-6)}{(x-6)(x-8)}=\frac{(x-4)-(x-2)}{(x-2)(x-4)}$

$\frac{-2}{(x-6)(x-8)}=\frac{-2}{(x-2)(x-4)}$

$(x-2)(x-4)=(x-6)(x-8)$

$x^2-6x+8=x^2-14x+48$

$8x=40$

$x=5$.

Mensuration.

Find (in acres, etc.) the area of a square whose diagonal is 9 chains 57 links.

9 chains 57 links = 957 links.

Area of square on diag. $=957\times957=915849$ links.

" side $=\frac{1}{2}$ of $915849=457924{\cdot}5$ links

$=4$ acres 2 r. 12 p. 3·7356 yds.

Arithmetic.

FEMALES.

1. What is the height of a steeple whose shadow was 112 ft. at the same time that a pole 6 ft. 4 in. long cast a shadow of 5 ft. 4 in.?

	ft.	ft.
Height of an object throwing shadow of	$5\frac{1}{3}$	$=6\frac{1}{3}$
" " "	1	$=\frac{6\frac{1}{3}}{5\frac{1}{3}}$
" " "	112	$=\frac{6\frac{1}{3}\times112}{5\frac{1}{3}}$

$=133$ feet. Ans.

2. Divide (*a*) ·0001 by ·00002.

(*b*) 1000 by ·0001.

(*c*) ·001 by ·0001.

(*a*) $\cdot0001\div\cdot00002=5$. Ans.

(*b*) $1000\div\cdot0001=10{,}000{,}000$. Ans.

(*c*) $\cdot001\div\cdot0001$

$=\frac{1}{10}\times\frac{2222}{1}$

$=\frac{1}{2}\times\frac{99{\cdot}90}{1}$

$=11{\cdot}1$. Ans.

3. Find the value of ·625 of a guinea + ·54 of 8s. 3d. + ·027 of £2 15s. 0d.

	s.	d.
·625 of a guinea $=\frac{5}{8}$ of 21s.	$=13$	$1\frac{1}{2}$
·54 of 8s. 3d. $=\frac{54}{100}\times\frac{99}{1}=54$d.	$=4$	6
·027 of £2 15s. $=\frac{27}{1000}\times\frac{55}{1}$s. $=\frac{3}{8}=$	1	6
	19	$1\frac{1}{2}$ Ans.

4. Express the difference between $\frac{4}{5}$ of 5s. 9d. and $\frac{7}{8}$ of 6s. 4d. as the decimal of half-a-guinea. (Work to 5 places of decimals only.)

$\frac{\frac{4}{5}\text{ of 5s. 9d.}-\frac{7}{8}\text{ of 6s. 4d.}}{\text{10s. 6d.}}$

$=\frac{\frac{4}{5}\times\frac{23}{4}-\frac{7}{8}\times\frac{19}{3}}{\frac{21}{2}}$

$=\frac{\frac{276}{5}-\frac{266}{8}}{\frac{21}{2}}$

$=\frac{1932-1900}{\frac{35}{1}}$

$=\frac{32}{35}\times\frac{1}{21}$

$=\frac{32}{735}$

$=$ ·00725+. Ans.

Grammar.

MALES AND FEMALES.

1. Analyse the following, parsing the words in italics:—

'*Lay* thy bow of pearl *apart*,
And thy crystal *shining* quiver,
Give unto the flying *hart*
Space to breathe *how short soever*,
Thou *that mak'st* a day of night,
Goddess excellently bright!'

BEN JONSON. *Hymn to Diana.*

2. Paraphrase it.

Sentence.	Kind of Sent.	Connective.	Subject.	Predicate.	Object.	Extension.
(*a*) Thou goddess excellently bright, lay thy bow of pearl apart.	P.S. contracted in subj		[Thou]	lay	thy bow of pearl	apart (place)
(*b*) And thy crystal shining quiver.	Do. co-ord. to (*a*)	and	[Thou]	[lay]	thy crystal shining quiver	[apart]
(*c*) Give unto the flying hart space to breathe how short soever.	P.S contracted in subj. co-ord. with (*a*)		[Thou]	give	how short soever space to breathe (dir.) unto the flying hart (ind.)	
(*d*) That mak'st a day of night.	Adj. to *thou* in (*d*)		that	mak'st	a day of night	

Lay—irreg. trans. verb, act., imp., pres., 2nd, sing., agreeing with its nom. *thou* understood.
apart—adv. of place, qualifying *lay*.
shining—pres. part., used as adj., qualifying *quiver*.
hart—com. noun, masc., sing., obj., gov. by *unto*.
space—abs. noun, neut., sing., obj., gov. by *give*.
how—adv. of deg., qualifying *soever*.
short—adj. of quality, qualifying *space*.
soever—adv. of degree, qualifying *short*.
that—rel. pro., agreeing with its antecedent *thou*, fem., sing., 2nd, nom. to *mak'st*.
mak'st—irreg. trans. verb, act., ind., pres., 2nd, agreeing with its nom. *thou*.
goddess—com. noun, fem., sing., nom. of address in apposition with *thou*.

PARAPHRASE.

2. O thou beauteous queen, who makest night like day, I pray thee put aside thy pearl-like bow, and the arrow-sheath which shines like silver; give to the hunted stag some short respite, however short that time of rest may be.

3. Of what origin is the suffix of the word 'goddess'? Mention other endings which indicate the feminine gender.

Latin. Other terminations indicating feminine gender: -ine, -trix, -ina, -na, -en, -a, -ster, -tress.

4. Most monosyllabic words are of English origin. Illustrate this by referring to the names of quadrupeds and trees.

Quadrupeds:—Horse, cow, sheep, pig, dog, cat, calf, goat, kid, lamb, foal, pup, mole, mouse, rat, bear, wolf, fox, deer, sloth.

Trees:—Oak, elm, ash, birch, beech, fir, pine, lime, pear, plum.

Geography.

(*Answer two Questions.*)

1. Give full notes of a lesson on the river Nile.

(*a*) *Situation.*—Show map of Africa, and enlarged map of Egypt. Use blackboard for names. The river of Egypt, and once object of wonder and veneration to ancients.

(*b*) *Source.*—Long unknown; notice old way of speaking of 'Mts. of the Moon.' Refer to travels of Livingstone, Speke, Baker, and Grant. Still matter of some doubt. Show number of lakes, Alb. Nyanza, Victoria Nyanza, etc. Former now taken as source of chief tributary, *Bahr-el-abiad*; *Bahr-el-azrek*, from Mts. of Abyssinia.

(*c*) *Course.*—Flows northward. Two streams join at Khartoum (notice central position), form one large stream, flowing through Nubia and Upper Egypt to Mediterranean. Cataracts formed, impassable for vessels except on Nile rising. Confined by hilly district. Widens as it nears Cairo. At capital divides, forms delta; Rosetta and Damietta at separate mouths.

(*d*) *Characteristics.*—Six cataracts. Annual overflow, resulting in great fertility of lower plain; large delta. Valleys called Wadys.

(*e*) *Towns.*—Khartoum, Berber, Dongola, Assouan, Minieh, Memphis, Cairo, Rosetta, Damietta; (Alexandria, Gizeh, Aboukir, near mouths.) Mention historical references, places of ancient greatness, pyramids, cities, etc.

2. Draw a map of the coast of Asia from Aden to Singapore.

3. Give an account of the monsoons of the Indian Ocean.

The monsoons of the Indian Ocean are modifications of the trade winds, and are due entirely to local causes. During the summer the vast arid plains of Thibet, Tartary, and Mongolia, become heated, and the usual trade winds are converted into south-west monsoons. In the other parts of the year these places are cooled rapidly by radiation, and the north-east monsoons prevail.

The south-west monsoons come laden with moisture from the Indian Ocean, and meeting the Ghauts great quantities of rain are precipitated. Crossing the country at the Himalayas they are reduced greatly in temperature, and snow is largely deposited on these heights. They now contain so little moisture, that the great deserts north of the Himalayas never get any rain.

The north-east monsoon carries rain to the east coast of Africa after crossing the Indian Ocean. The change from one monsoon to the other is gradual, and is often accompanied by storms of wind and rain.

SECOND PAPER.

Two hours and a half allowed.

Needlework.

FEMALES.

The needlework specimens will be collected by the Inspector at the expiration of one hour after the distribution of the examination paper.

Arithmetic.

MALES.

1. The (true) present worth of a bill due a year hence is £355, what is the amount of the bill, interest being at 3½ per cent. per annum?

Discount taken off is the Int. of P.W.

$$\therefore \text{Debt} = £355 + \frac{355 \times 3\frac{1}{2}}{100}$$
$$= £355 + £12\ 8s.\ 6d.$$
$$= £367\ 8s.\ 6d. \text{ Ans.}$$

2. A grocer bought 1 cwt. of tea for £11 5s., and sold half of it at 2s. 4d. per lb. and half at 2s. 6d. per lb.; what did he gain per cent.?

	£	s.	d.
Selling price = 56 at 2s. 4d. =	6	10	8
56 at 2s. 6d. =	7	0	0
	£13	10	8

Gain = £13 10s. 8d. − £11 5s. = £2 5s. 8d.

$\therefore$ Gain per cent. = £11 5s. : £100 :: £2 5s. 8d. : x

$= 20\frac{8}{17}$. Ans.

3. If a square plot of ground contains 961 square yards, how many palings placed a yard apart will be required to go round it?

Side of sq. = $\sqrt{961}$ yards = 31 yards.

$\therefore$ No. of palings = $31 \times 4 = 124$. Ans.

4. If a hare starts 15 yards before a hound and takes 7 leaps of 6 feet each in 2 seconds, whilst the hound takes 9 leaps of 9½ feet each in 4 seconds; in what time will the hound catch the hare?

Speed of hare per sec. $= \frac{7 \times 6}{2} = 21$ feet.

" hound " $= \frac{9 \times 9\frac{1}{2}}{4} = 21\frac{3}{8}$ feet.

Gain per sec. $= 21\frac{3}{8}$ ft. − 21 ft. $= \frac{3}{8}$ foot.

Time to go $\frac{3}{8}$ ft. = 1 sec.

" " $\frac{1}{8}$ " $= \frac{1}{3}$

" " 45 " $= \frac{1}{3} \times 45 \times 8$

$= 120$ secs. $= 2$ mins. Ans.

History.

MALES AND FEMALES.

1. Write a short life of James I. and his consort.

James I. of England was the son of Mary Queen of Scots and Lord Darnley, her second husband. On the flight of his mother he became King of Scotland, and on the death of his cousin Elizabeth he became King of England (1603), having married Anne of Denmark in 1590, by whom he had two sons and a daughter. He was learned, but pedantic and conceited. On his accession it became his interest to encourage the doctrine of the 'divine right' of kings, a doctrine which ultimately led to the dethronement of the Stuarts. Early in his reign (1605) occurred the Gunpowder Plot, organised to favour the Roman Catholics; the translation of the Bible was completed (1611), and Ulster was colonized. James was fond of favourites. He first chose Robert Carr, and afterwards George Villiers, whom he created Duke of Buckingham. Anne had a great dislike to the Duke of Buckingham, who was sent to arrange a marriage between Charles, James's eldest son, and the Infanta of Spain. The match, owing to the opposition of the people, did not take place, and Buckingham was disgraced. In this reign Sir Walter Raleigh was released, and went to America in search of gold, but quarrelled with the Spaniards, who clamoured for his execution. Queen Anne tried to save him, but didn't succeed, and he was executed in 1618. James died in 1625, and was succeeded by his son Charles.

His consort Anne died in 1619.

2. Describe Monmouth's insurrection and its suppression.

Immediately after the accession of James II., the Duke of Monmouth landed from the Low Countries, at Lyme in Dorsetshire, and was proclaimed king at Taunton, in 1685. The people in the Western counties flocked to his standard in large numbers, but he was unsupported by the nobility. He attempted to surprise the royal army on Sedgemoor, but was defeated, although his infantry, many armed only with scythes, fought very bravely. Monmouth fled from the field, and was captured two days afterwards. He was beheaded on the 15th July, and his followers were treated with great severity. Many were summarily hanged by Colonel Kirke, whose ferocious soldiers were known as 'Kirke's Lambs.' Then the 'Bloody Assize' was held by Judge Jeffreys, and more than 300 persons were executed, and double that number sold as slaves to the plantations in the West Indies.

3. What was the fate of George IV.'s wife and daughter.

George IV. had married his cousin Caroline, Princess of Brunswick, in 1795, from whom he soon parted. A Bill of Pains and Penalties was brought into Parliament soon after his

accession, to degrade and divorce the Queen on charges of misconduct. The Bill was eventually dropped, but on her presenting herself at the door of Westminster Abbey on the day of the King's coronation, she was refused admittance, and died soon after broken-hearted, August 7th, 1821.

Princess Charlotte married Prince Leopold of Saxe-Coburg, but died, much to the regret and sorrow of the whole nation, after giving birth to a still-born son, on the 4th November, 1818.

Teaching.

Write the notes of a lesson on the 'Races of Mankind.'

(*a*) *Introduction.*—Elicit the fact that all people of the world are not alike in appearance, in colour, stature, etc. Certain peculiarities mark different classes of men.

(*b*) *Varieties of Race.*—Five chief divisions: Caucasian, Mongolian, Malay, Negro, American or Indian.

(*c*) *Distinguishing Features of Various Races.*—Show coloured print, and from examination show:—

1. *Caucasian.*—Has oval face, regular features, hair long, fine, and in waving curls, head well formed, high forehead, upper and back parts well rounded. The most civilized, refined, and powerful nations, both ancient and modern, are of this race.

2. *Mongolian.*—Projecting cheek-bones, flat face, broad skull, flattened at the sides, small eyes obliquely set, yellowish skin, straight black hair, little or no beard.

3. *Malay.*—Skin varies from a light tawny to a deep brown, hair black, crisp, and inclined to curl, head narrow, nose full, and broad towards the lips, bones of face large and prominent.

4. *Negro.*—Black, woolly hair, low and slanting forehead, projecting jaw, flattened nose, thick lips, and black skin.

5. *American.*—Reddish or copper-coloured skin, regular features, aquiline nose, high but retreating forehead.

Compare Mongolian and American; latter an offshoot from former. Malay also a mixture of Mongol and Negro.

Distribution.—(1) Turkey, Arabia, Persia, Hindostan in Asia, nearly all Europe, Egypt and Mediterranean coast of Africa, large areas of N. and S. America, Cape Colony, and Australia.

(2) Central and northern parts of Asia, China, Japan, Burmah, Siam, and Cochin China; Turks, Finns, and Lapps in Europe; and Esquimaux in N. America.

(3) Malay peninsula, Malaysia, Australasia, and Polynesia.

(4) Nearly all Africa.

(5) Parts of the W. of N. America.

Mental and Moral Comparison of Races.—Compare the abilities, the moral and mental faculties of races, show their separate places as regards civilization, and see how physical conditions affect for good or ill the different races.

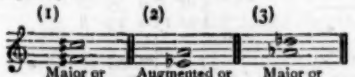
Music.

A quarter of an hour allowed for this paper.

(N.B.—Pupil Teachers may answer the questions in either the Staff Notation or the Tonic Sol-fa, but *not both*. The questions in the Tonic Sol-fa Notation will be found at the end.)

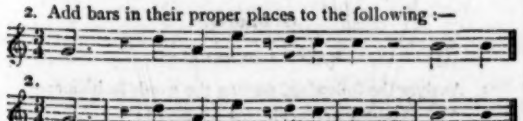
1. Write below each of the following intervals its name (minor third, &c.):—

1. (1) (2) (3)

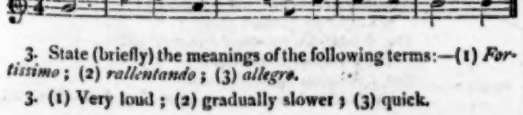


Major or Perfect 5th. Augmented or Pluperfect 4th. Major or Perfect 4th.

2. Add bars in their proper places to the following:—



2.



3. State (briefly) the meanings of the following terms:—(1) *Fortissimo*; (2) *rallentando*; (3) *allegro*.

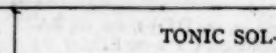
3. (1) Very loud; (2) gradually slower; (3) quick.

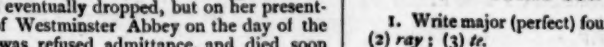
TONIC SOL-FA NOTATION.

1. Write major (perfect) fourths above the following:—(1) *fah*; (2) *ray*; (3) *te*.

1. (1) *ta*; (2) *soh*; (3) *me'*.

2. Re-write the following, doubling the value of every note and rest. Use four-pulse measure:—



2. 

3. What do the following terms mean:—(1) *Fortissimo*; (2) *rallentando*; (3) *allegro*?

3. (1) Very loud; (2) gradually slower; (3) quick.

FOURTH YEAR.

Pupil Teachers at end of Fourth Year.

FIRST PAPER.

Three hours and a half allowed.

Euclid.

MALES.

[All generally understood abbreviations for *words* may be used.]

Answer two Questions, including No. 3, if you can.

1. If there be two straight lines, one of which is divided into any number of parts, the rectangle contained by the two straight lines, is equal to the rectangles contained by the undivided line, and the several parts of the divided line.

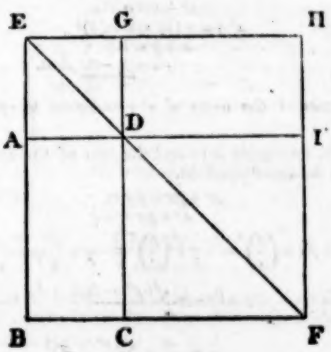
Euclid, Book II., Prop. 1.

2. In every triangle, the square on the side subtending either of the acute angles, is less than the squares on the sides containing that angle, by twice the rectangle contained by either of these sides, and the straight line intercepted between the acute angle and the perpendicular let fall upon it from the opposite angle.

Euclid, Book II., Prop. 13.

3. Any rectangle is half the rectangle contained by the diameters of the squares upon its two sides.

Let ABCD be a rectangle. ABCD = half rect. contained by diags. of sqs. on BA and AD.



On AD describe sq. AG. Join ED, and produce to meet BC produced in F. Through F draw FH parallel to BA. Produce EG and AD to meet FH in H and I.

Then BH is the sq. on BE, and AG and CI sqs. on BA.AE. (I. 43, 44.)

The sq. on BE = sqs. on BA.AE + 2 rect. BA.AE. (II. 4.)

And 2 sq. on BE = 2 sqs. on BA.AE + 4 rect. BA.AE. (Ax. 6.)

But sq. on EF = 2 sq. on BE (I. 47.)

∴ Sq. on EF = 2 sqs. on BA.AE + 4 rect. BA.AE. (Ax. 6.)

And sq. on EF = sqs. on ED.DF + 2 rect. ED.DF. (II. 4.)

∴ Sqs. on ED.DF + 2 rect. ED.DF = 2 sqs. on BA.AE + 4 rect. BA.AE. (Ax. 1.)

But sq. on ED = 2 sq. on EA, and sq. on DF = 2 sq. on BA. Take away these equal parts, and remainder 2 rect. ED.DF = 4 rect. BA.AE. (Ax. 3)

I.e., rect. BA.AE = ½ rect. ED.DF.

But BA.AE = rect. BD, and ED.DF are the diags. of the sqs. on sides of BD.

Wherefore, any rectangle, etc. Q. E. D.

Algebra.

Answer two Questions, including No. 3, if you can.

1. Add $\frac{x-y}{x^3-xy-2y^2}$ to $\frac{x+y}{x^2-3xy+2y^2}$.

$$\frac{x-y}{x^3-xy-2y^2}+\frac{x+y}{x^2-3xy+2y^2}$$
$$=\frac{x-y}{(x-2y)(x+y)}+\frac{x+y}{(x-2y)(x-y)}$$
$$=\frac{(x-y)^2+(x+y)^2}{(x+y)(x-y)(x-2y)}$$
$$=\underline{\frac{2(x^2+y^2)}{(x^2-y^2)(x-2y)}}. \text{ Ans.}$$

2. Solve (1) $\frac{5x}{6}-\frac{3y}{7}=2=\frac{x}{2}-\frac{y}{7}$

(2) $\frac{x+1}{x}+\frac{x}{x+1}=2\frac{1}{2}$.

(1) $\frac{5x}{6}-\frac{3y}{7}=2=\frac{x}{2}-\frac{y}{7}$.

$35x-18y=84$ (1)

$7x-2y=28$ (2)

Mult. 2 by 5

$35x-18y=84$

$35x-10y=140$

$-8y=-56$

$y=\underline{7}$

Substitute value of y in (1).

$35x-126=84$

$35x=210$

$x=6$

$\underline{6, 7}$. Ans.

(2) $\frac{x+1}{x}+\frac{x}{x+1}=2\frac{1}{2}$.

L.C.M. $=6x(x+1)$

$6x^2+12x+6+6x^2=13(x^2+x)$

$x^2+x=6$

$x^2+x+(\frac{1}{2})^2=6+(\frac{1}{2})^2$

$x+\frac{1}{2}=\pm\frac{5}{2}$

$x=\underline{2, -3}$. Ans.

3. The sum of the roots of $x^2+px+q=0$ is $-p$, and their product is q.

Prove this, and apply it to find the sum of the reciprocals of the roots of the same equation.

$$x^2+px+q=0.$$
$$x^2+px=-q$$
$$x^2+px+\left(\frac{p}{2}\right)^2=-q+\left(\frac{p}{2}\right)^2=-q+\frac{p^2}{4}=\frac{p^2-4q}{4}$$
$$x+\frac{p}{2}=\pm\frac{\sqrt{(p^2-4q)}}{2}$$
$$x=-\frac{p}{2}\pm\frac{\sqrt{(p^2-4q)}}{2}$$
$$=\frac{-p\pm\sqrt{(p^2-4q)}}{2}$$
$$\frac{-p+\sqrt{(p^2-4q)}}{2}+\frac{-p-\sqrt{(p^2-4q)}}{2}=\frac{-2p}{2}$$
$$=\underline{-p}.$$
$$\frac{-p+\sqrt{(p^2-4q)}}{2}\times\frac{-p-\sqrt{(p^2-4q)}}{2}$$
$$=\frac{p^2-(p^2-4q)}{4}=\underline{q}.$$

Reciprocals of roots added,

$$=\frac{2}{-p+\sqrt{(p^2-4q)}}+\frac{2}{-p-\sqrt{(p^2-4q)}}$$
$$=\frac{2}{-2p}=\underline{\frac{1}{-p}}. \text{ Ans.}$$

Mensuration.

Give the rules: (1) for finding the area of a triangle when the three sides are given; (2) for finding the length of a circular arc when the angle it subtends at the centre and the radius of the circle are given. Apply the latter to find the length of a quadrant.

(1) From half the sum of the three sides subtract each side separately, then multiply the half sum and three remainders together, and the square root of the product will be the area.

(2) Multiply the radius of the circle by the No. of degrees in the arc, and that product by ·01745329, and the last product will be the length of the arc.

Suppose the radius = 6 in.

Then $6\times90\times\cdot01745329=\underline{9\cdot4247766 \text{ in.}}$ Ans.

Arithmetic.

FEMALES.

1. If eighteen men can dig a trench 17 yards long and 2 yards wide in 17 days, working 5 hours a day, how many men will dig a trench 12 yards long and 4 yards broad in 9 days, working 8 hours a day?

yds. 17 : 12 :: 18 men : x men
yds. 2 : 4
days 9 : 17
hours 8 : 5
$=\underline{30 \text{ men.}}$ Ans.

2. Find the difference between the banker's and true discount on £325 due twelve months hence at 4½ per cent. per annum.

Banker's discount = int. on debt.

$\therefore \frac{325\times4\frac{1}{2}}{100}=£14$ 12s. 6d.

True discount = int. on P. W.

£100 in 12 months yields £4½.

£ £ £
$\therefore 104\frac{1}{2} : 4\frac{1}{2} :: 325 : x$
$=£13$ 19s. $10\frac{17}{19}$d.
Diff. $=\underline{12\text{s. } 7\frac{2}{19}\text{d.}}$ Ans.

3. A man invests £1274 in the 3½ per cents. at 91. What income does he derive thence? (Omit brokerage.)

For every £91 invested he gets 3½.

$\therefore$ Income $=\frac{1274\times3\frac{1}{2}}{91}$
$=\underline{£49}$. Ans.

4. In a class of children 10 are 8 years old, 8 are 9 years old, 12 are 10 years old, 1 is 11 years old, 5 are 7 years old, and 1 is 15 years old. Find the average age of the children in the class.

	years
10 at 8	= 80
8 at 9	= 72
12 at 10	= 120
1 at 11	= 11
5 at 7	= 35
1 at 15	= 15
37	= 333
1	= 9. Ans.

Grammar.

MALES AND FEMALES.

1. Analyse the following, parsing the words in italics:—

No *voice divine* the *storm* allayed;
No light propitious shone;
When snatched from *all* effectual aid
We *perished each alone*;
But *I* beneath a *rougher* sea
And *whelmed* in deeper gulphs *than he*.—COWPER.

2. Point out any words in the above derived from Latin, or from Latin through French.

ANALYSIS.

Sentence.	Kind of Sentence.	Connective.	Subject.	Predicate.	Object.	Extension.
(*a*) No voice divine the storm allayed;	Princ. sent.		no divine voice	allayed	the storm	
(*b*) No light propitious shone;	Princ. sent.		no propitious light	shone		
(*c*) When snatched from all effectual aid we perished each alone;	Adj. sent. (time) to *b*	when	we, each snatched from all effectual aid	perished		alone (manner)
(*d*) But I beneath a rougher sea	Princ. disj. co-ord. with *c*	but	I	[perished]		beneath a rougher sea (place)
(*e*) And whelmed in deeper gulphs	Princ. co-ord. with *d*	and	I	[was] whelmed		in deeper gulphs (place)
(*f*) than he.	Adv. sent. to *e*	than	he	[was whelmed]		[in deep gulphs.]

Voice—com. noun, neut., sing., nom. to *allayed*.
divine—adj. of quality, qual. *voice*.
storm—com. noun, neut., sing., obj., gov. by *allayed*.
no—adj. of number, qual. *light*.
when—adv. conj., cop., joining the sents. 'We perished' and 'no light shone.'
snatched—past part. of to *snatch*, qual. *we*.
all—indef. numl. adj., qual. *aid*.
perished—reg. intrans. verb, act., ind., past, 1st plur., agreeing with *we*.
each—adj., dist. numl., qual. person understood, *or* indef. pers. pro. in apposition with *we*.
alone—adv. of manner, qual. *perished*.
I—pers. pro., masc., sing., 1st, nom. to *perished*.
beneath—prep., showing reln. between *sea* and *perished*.
rougher—adj. of quality, comp. deg., qual. *sea*.
whelmed—past part. of *to whelm*, referring to *I*.
than—cop. conj., joining the sents. 'I was whelmed' and 'he was whelmed.'
he—pers. pro., masc., sing., 3rd, nom. to *was whelmed*.

2. Latin:—voice, divine, propitious, effectual.
Latin through French:—aid, perished.

3. In English almost any part of speech may be used as any other part of speech. Illustrate this.

Ex. 1. The word *round* may be
(1) An adjective, as, Round holes are made by tools.
(2) A noun, as, The daily round of duty was performed.
(3) A verb, as, Round the edges of the stone for me.
(4) An adverb, as, Turn round.
(5) A preposition, as, Go round the house.

Ex. 2. The word *that* may be
(1) An adjective, as, That man.
(2) A relative pronoun, as, This is the house that was struck by lightning.
(3) A compound relative, as, We speak that we do know.
(4) A conjunction, as, I told him that he could not succeed.

Ex. 3. The word *but* is
(1) A conjunction, as, I came, but he stayed.
(2) A preposition, as, All but him had fled.
(3) A noun, as, He stopped me with a 'But.'
(4) A verb, as, But me no buts.
(5) An adverb, But few (only a few) remained till the end.

4. To what period of our literature do the following writers respectively belong:—Alfred the Great, Chaucer, Spenser, Cowper?

Alfred the Great—Old English (450-1100).
Chaucer ... ... Middle English (1250-1485).
Spenser, Cowper ... Modern English (1485 to 1884).

Geography.

(*Answer two Questions.*)

1. Give full notes of a lesson on the Seasons.

Use the globe, an illustration of the seasons, the blackboard, and, if possible, a number of small globes representing the earth as the sun shines on it at different parts of the year.

Cause of Seasons.—Notice the inclination of the earth's axis to plane of its orbit, and that it is always parallel to itself. Make the globe revolve in different parts of the orbit, and show that different parts of the earth receive more or less heat from the sun, and get more of its rays at one time than they do at another. From these deduce: (1) That the cause of the seasons is the varying extent of the sun's influence at different times.

(2) That this varying extent is caused by
(*a*) The earth's axis being inclined.
(*b*) The earth's movement round the sun.
(*c*) The earth's axis being always parallel to itself.

Names and Times of Seasons.—Spring, summer, autumn, winter. Sun vertical to equator twice in the year, when the earth is at opposite ends of a diameter of its orbit, 21st of March and 23rd September. These are times of equal day and night, and called equinoxes.

Sun's rays vertical on Tropic of Cancer 21st June. This is the summer solstice of northern hemisphere (explain solstice), and it is winter of southern hemisphere. Sun vertical on Capricorn 21st December. Summer solstice of southern hemisphere, winter of northern. Illustrate clearly by model and diagram.

Benefit of Seasons.—Variety of climate, products, etc.

2. Draw a map of South America.

3. Contrast the Pacific with the other oceans.

The Pacific is by far the largest of the oceans. In shape it is oval, while that of the Atlantic is a cleft between the two continents, and while it occupies a large proportion of the Torrid Zone, and is, therefore, very hot, the Arctic and Antarctic are covered with eternal ice. While all the other oceans are comparatively destitute of islands, the Pacific is studded with thousands of them, which thus form one of its most distinctive features. The Atlantic is open to the Arctic, but the Pacific has only a connection by Behring's Strait, 36 miles across, and comparatively shallow (25 fath.) The Pacific is not so important a highway for traffic as the Atlantic. The greatest depths of ocean have been found in the Pacific. The great tidal wave has its commencement in the Pacific, but owing to its immense size and freedom from obstruction, its tides are more even, and not so high as those of the Atlantic.

SECOND PAPER.

Two hours and a half allowed.

Needlework.

FEMALES.

The needlework specimens will be collected by the Inspector at the expiration of one hour after the distribution of the examination papers.

Arithmetic.

MALES.

1. Find the exact square root of $5\frac{39}{121}$, and the square root of $\frac{3}{11}$ to 4 decimal places.

$$\sqrt{5\tfrac{39}{121}} = \sqrt{\tfrac{644}{121}} = \tfrac{23}{11} = 2\tfrac{1}{11}. \text{ Ans.}$$

$$\tfrac{3}{11} = .18181818$$

.18181818(.4264. Ans.
16
82) 218
164
846) 5418
5076
8524) 34218
34096
122

2. If a man invests money in 4½ per cent. railway debentures at 137½, what dividend per cent. does he get for his money, the usual brokerage being charged?

For every $137\frac{1}{2}+\frac{1}{4}$ he gets $4\frac{1}{4}$.
$\therefore 137\frac{1}{2} : 100 :: 4\frac{1}{4} : x$
$= \frac{275}{2} \times \frac{100}{1} \times \frac{17}{4}$
$= 3\frac{825}{2}$. Ans.

3. Find the simple interest on £875 from March 10th, 1884, to May 22nd, 1885, at 5 per cent.

From March 10th, 1884 to May 22nd, 1885 = 438 days.
Int. on £875 for 1 year $= \frac{875 \times 5}{100} =$ £43 15s.

days. days. £ s.
$\therefore 365 : 438 :: 43\ 15 : x$
$=$ £52 10s. Ans.

4. A, B, and C, whose capitals are as ½, ⅓, and ¼, join in partnership, and after six months A and B increase their capitals by one-half of their original amounts. How would a gain of £275 be divided amongst the three at the end of 9 months?

A's share of capital $= (\frac{1}{2} \times 6) + (\frac{3}{2} \times 3) = 5\frac{1}{2}$
B's ,, ,, $= (\frac{1}{3} \times 6) + (\frac{1}{2} \times 3) = 3\frac{1}{2}$
C's ,, ,, $= (\frac{1}{4} \times 9) = 2\frac{1}{4}$
11

£ £ s.
$\therefore$ A's share of profits $= \frac{5\frac{1}{2}}{11}$ of 275 = 131 5 Ans.
B's ,, ,, $= \frac{3\frac{1}{2}}{11}$ of 275 = 87 10 Ans.
C's ,, ,, $= \frac{2\frac{1}{4}}{11}$ of 275 = 56 5 Ans.

History.

MALES AND FEMALES.

1. What right had James I. to the English throne? Assuming the first Tudor to have been a successful usurper, show that the Stuarts had other claims.

James the First was descended from the eldest daughter of Henry VII., and her brother, Henry VIII., left no lineal descendant after the death of Elizabeth. He was thus the nearest relative of Elizabeth, and as such had the hereditary claim to the throne on her decease.

Assuming that Henry VII. was a successful usurper, the Stuarts might have claimed the throne because they were descendants from James I. of Scotland, who married in 1423 Joanna Beaufort, the daughter of the Duchess of Clarence, by her first husband, the Duke of Somerset, and the descendant of Edward III. by both her parents.

2. By what arguments was the legislative union of Great Britain and Ireland supported? Compare the chief articles of the Scotch Union Act with the corresponding Act for Ireland.

It was urged in support of the Union, that the situation of the two countries was so close, their interests were so identical, that it would be mutually advantageous. But more especially that the emissaries of foreign nations, whose actions were inimical to the well-being of England, would be less powerful, and the chances of discontent and rebellion less great if the Union took place.

The Scottish peers elected were representative only for a parliament, the Irish were elected for life.

Scotland sent 45 members to the House of Commons, Ireland 100.

The title of the country at the union with Scotland called Great Britain, was now changed to Great Britain and Ireland. The union with Scotland provided for each retaining its National Church. The Irish Union Act did not. The Scottish Union Act provided that Scotland should retain its own laws, and administration of the same. The Irish did not.

Each Act provided for the union of the national flags in one.

3. Describe briefly the object and the provisions of the Reform Bill of 1832.

The object of the Reform Bill of 1832 was to amend the representative character of Parliament, to lower the qualification for the franchise, and to increase the electorate. It provided for the disfranchisement of 54 places with less than 2000 inhabitants, and the reduction of the number of members from two to one where the population was between 2000 and 4000. The 143 seats thus obtained were given to the counties, to the metropolis, and to towns of modern growth. It reduced the franchise in boroughs to £10 occupiers, in counties to 40s. freeholders, £10 copyholders, and £50 rental. It shortened the time of election, and provided for registration of voters.

Teaching.

Write out notes of a lesson on the 'MIGRATION OF BIRDS.'

Necessity for Migration.—Note the differences of climate in this and other countries, and the necessity for more clothing in winter than summer. If unobtainable, then change of climate necessary. This latter, the practice with birds.

Birds which Migrate.—Commonest and best known among us, the swallow; wild ducks, cranes, geese, fieldfares and many others, remove to a warmer climate in our winter, and return to us in spring and early summer.

Preparation for Flight.—Notice the gathering of the swallows on the housetops and in the stack-yards and fields, then the rapid flight. Speak of the great flocks of cranes, and geese, and ducks, which visit the fen districts during the later autumn; also notice the height at which the birds fly. Voices often heard, but birds out of sight. Reverse the order, and note the coming of the birds, and the service they render by clearing the atmosphere and earth of troublesome and hurtful insects.

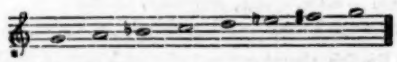
Music.

A quarter of an hour allowed for this paper.

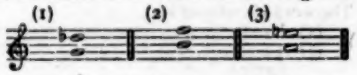
(N.B.—Pupil Teachers may answer the questions in either the Staff Notation or the Tonic Sol-fa, but *not both*. The questions in the Tonic Sol-fa Notation will be found at the end.)

1. Write in the treble clef the ascending scale of G minor, using the minor sixth and the sharp seventh, placing the necessary flats, &c., before the notes.

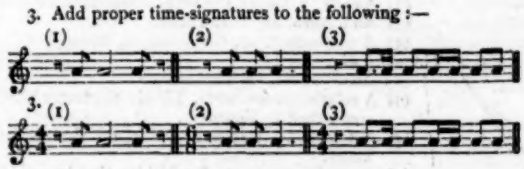
1.



2. Write diminished fifths above the following notes:—



3. Add proper time-signatures to the following:—



TONIC SOL-FA NOTATION.

1. Write an ascending minor scale from *lah*, to *lah*, using the major sixth and the sharpened seventh.

1. l, t, d r m fa se l

2. Write diminished fifths above the following notes:—
(1) *lah*, ; (2) *ray*; (3) *me*.

2. (1) *ma*; (2) *la*; (3) *ta*.

3. Re-write the following, halving the value of every note and rest. Use two-pulse measure:—

3. |m :-.f |r :— | :m |r :d ‖
|m .,f :r | .m :r .d ‖

The Practical Teacher.

A MONTHLY EDUCATIONAL JOURNAL.

To Subscribers.—The *Practical Teacher* is published on the 25th of every month. Price 6d.; post free, 7½d.; sent post free, three months for 1s. 11d.; six months, 3s. 9d. a year, 7s. 6d.

P. O. Orders should be made payable at Chief Office.

Subscribers not receiving their copies regularly are respectfully requested to write to the Publisher.

It would save time and expense if subscribers when remitting would state exactly what numbers they wish to be sent.

To Correspondents.—All literary communications should be addressed, THE EDITOR OF THE PRACTICAL TEACHER, Pilgrim Street, Ludgate Hill, London, E.C.

Accepted contributions are paid for within twenty-one days of publication.

The Editor cannot return rejected MSS.; authors should therefore retain copies.

TO ADVERTISERS.

Approved, *prepaid*, advertisements will be inserted in the *Practical Teacher* at the following rates:—

	s.	d.
20 words or under	3	0
Above 20 words and under 32 words ...	4	0
32 words and under 64 words	5	0
For every additional 10 words	1	0

Teachers Advertising for Situations.

	s.	d.
20 words or under	1	0
For every additional 10 words	0	6

For an ordinary page	4 guineas.
For page facing matter	5 guineas.
For 2nd page of wrapper	5 guineas.
For 3rd page of wrapper	5 guineas.
For the page opposite the 3rd page of wrapper	5 guineas.
For the 4th (back) page of wrapper ...	6 guineas.

Parts of a page are charged at a slightly higher rate.—Special quotations will be given for a series.

Portfolios, fitted with elastic bands, for preserving twelve numbers of 'The Practical Teacher,' may now be had. Price 2s. 6d. Orders should be given through booksellers.

The numbers of the *Practical Teacher* for February and March, 1884, are now out of print.

Matriculation Hints.

BY HENRY A. REATCHLOUS, M.A. (LOND.), B.Sc.,

Westminster Training College.

THE student has already had occasion to consider the notion of Rate; Velocity, Acceleration, and Force being instances. Five per cent. per annum is a rate of interest; five feet per second per second, which is the same as 300 feet per second per minute, is a rate of acceleration. This notion of rate is of far greater importance and far wider application than appears at first sight, and it should not be passed over until it is completely understood.

But it will be asked is Force nothing but a rate, having no more real objective existence than five per cent.? Most of the existing text-books define it as 'Any cause that changes or tends to change a body's state of rest or motion.' But it was not so defined by Newton; nor is it so used by Thomson and Tait, who have no doubt fixed the meaning of the word for the time to come.

If bodies move, they must do so in some direction and with some velocity. Hence we can represent velocities, accelerations, and forces on paper by drawing lines in the direction the body would move, and proportional to these rates.

Here the student cannot do better than go a little out of his way to learn the meaning of the terms Sine, Cosine, and Tangent. With centre O and radius OP describe a circle. Draw through O a horizontal and a vertical diameter, AOA', BOB' respectively. Suppose now the radius OA' to revolve about the point O in a direction opposite to that of the hands of a watch, When the radius has travelled through 15 degrees drop a perpendicular from A' upon the horizontal line which was its original position. Do this for each 15 degrees up to 90. We have now a set of right-angled triangles, of which the bases have become smaller, the perpendiculars larger, and the hypothenuses remained equal. Now in any right-angled triangle the ratio of the

$\frac{\text{Perpendicular}}{\text{Hypothenuse}}$ is called the Sine of the angle subtended by the perpendicular; the

$\frac{\text{Base}}{\text{Perpendicular}}$ is called the Cosine of the same angle, and the

$\frac{\text{Perpendicular}}{\text{Base}}$ or $\frac{\text{Sin}}{\text{Cos}}$ is called the Tangent of the angle.

As the radius is a constant quantity, it will be seen that the sines and cosines are represented by the perpendiculars and bases of the right-angled triangles, that the sines increase from 0 up to unity (taking the radius as unity) as the angle increases from 0 to 90 degrees, and that the cosine decreases from unity to 0 under like conditions, and, consequently, the tangent being the ratio of the first of these to the second will vary from 0 to infinity as we pass from no degrees to 90. These perpendiculars and bases (sines and cosines) can be easily calculated in terms of the radius for the angles 30°, 45°, and 60°. The student should draw the figures and work them out for himself. We give the values of the sine, cosine, and tangent for the following angles.

Angles	0°	30°	45°	60°	90°
Sine	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1
Cosine	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0
Tangent	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	∞

The terms **Component, Resultant,** should be clearly understood. We often require to find the velocity, acceleration, or force in other directions than the one in which the body is moving at the time. The most important case of resolution is where we want to replace the velocity by two others at right angles to each other. Let the straight line AB represent the velocity in magnitude and direction. Suppose we want to resolve it along the line AC, which makes an angle of 30 degrees with AB, and along another line AD at right angles to AC. Through B draw BC and BD at right angles to these two lines respectively. AC and AD will represent the velocities required.

$$\text{But } \frac{AC}{AB} = \text{Cosine of } 30, \text{ and } \frac{AD}{AB} = \text{Sine of } 30^\circ$$

$$\text{That is } AC = AB.\text{Cos. } 30, \text{ and } AD = AB \text{ Sin. } 30^\circ.$$

Hence, to resolve a force in any direction, with the one in which it is acting, we have only to multiply the number representing the force by the cosine of the angle which that direction makes with its own.

The proposition called the parallelogram of forces should be well studied. There is often some confusion about what is called the triangle of forces, perhaps because the two lines are not the actual paths along which the forces act, but only parallel to them.

If three forces are in equilibrium, any one of them is equal and opposite to the resultant of the other two. If we resolve any number of forces acting on a particle in two directions at right angles to one another, and the sum of these resolved parts vanishes in both directions, there will be equilibrium. We have hitherto taken it for granted that the forces act in one place, and that the motion is that of translation.

But for a rigid body to be at rest there must not only be no motion of translation, there must be none of rotation. When the direction of a force does not pass through a point, it may produce a motion of rotation about that point, and its **importance** in that respect is called the **moment** of the force about that point. It is measured by the product of the number of units of force, and the number of units of length in the perpendicular from the point upon the direction of the force. Consider a lever in equilibrium. Disregard the weight of the lever, and suppose unequal masses are attached to the ends. Then if the lever is horizontal, the forces are acting at right angles to the arms, and the moment, tending to twist the lever in one direction, will be the product of the number of units of length on the arm and the number of units of mass attached to it, and the moment tending to twist it in the opposite direction will be the product of the number of units in the other arm and the number of units of mass attached to it. In case the forces should not be acting at right angles to the arms, we must find the number of units of length in the perpendicular let fall upon the direction from the fixed point, and multiply these by the number of units of mass. What is called the principle of moments is sometimes stated thus: If two forces meet in a point, their moments with respect to any point in their resultant are equal and opposite.

The centre of gravity of a body is a point through which the resultant of the attractions on all the particles of the body passes, whatever be the position of the body. The centre of gravity of a line, circumference and area of a circle, perimeter and area of a parallelogram, sphere and cylinder should be considered. The student should also find the centre of gravity of a number of heavy particles at fixed distances from each other, and also of a thin sheet of metal in the form of a triangle.

The simple machines with the conditions of equilibrium between the power and the weight in each should be carefully prepared. These are usually pretty fully given, and involve no great difficulty.

(To be continued.)

—o—

Award of the 'Practical Teacher' School-Song Competition.

R. DUNSTAN, ESQ., has kindly acted as judge.

CLASS I. In order of Merit:—

(1) 'Don Cæsar de Bazan' (1st Prize).
WM. REES, Meliden National School, Rhyl, North Wales.

(2) 'Black Combe' (2nd Prize).
E. N. LEWIS, The Burlington Schools, Kirkby-in-Furness.

(3) 'Fidelis.' (4) 'Viola.' (5) 'Sunshine.' (6) 'Dum Spiro Spero.' (7) 'Winter.' (8) 'R.'

CLASS II. In chance order:—

'Holiday.' 'Harmonicus' 'Egroeg' 'Kettledrum.' 'Amateur.' 'Broughton Wood.' 'Little Blue Eyes.' 'Bartle Massey.'

CLASS III. In chance order:—

'I'll Try.' 'Nil desperandum.' 'King Eddlebert.' 'Merle.' 'Greyhound.' 'Hope.' 'Zo.' 'Amen.'

CLASS IV.

Not in accordance with rules of Competition:—

'M. I. P.'

ACTION SONG FOR INFANTS.

In order of Merit:—

(1) 'Rex' (1st Prize).
R. P. GRAHAM, Board Schools, Harrington, Cumberland.

(2) 'A tempo' (2nd Prize).
EDWARD J. HAINES, Board School, Highgate, N.

(3) 'Black Combe.' Highly commended.
(4) 'Bartle Massey.'
(5) 'Winter.'
(6) 'The Captain.'
(7) 'Delta.'
(8) 'Tantsodiume.'

*** The Money Prizes in connection with the above Competition have already been paid. We hope to print the two First Prize Songs in our next issue.—ED. P. T.

Query Column.

RULES.

1. Each correspondent is restricted to *one question.* We should be much obliged if correspondents, who send questions for solution, would give (if possible) the required answer, and the source from which the question is obtained.

2. No query can be answered unless accompanied by the real name and address of the sender, not necessarily for publication, but as a guarantee of good faith and for facility of reference.

3. ☞ When a pseudonym is adopted it should be written at the end of the query, and the real name and address on a separate piece of paper.

4. Correspondents are requested to write their queries *legibly*, and on one side of the paper only.

5. Replies will not be sent through the post.

6. Queries must reach the office *not later than the 12th of the month*, or they cannot be attended to in the following issue.

⁂ All communications for this column should be addressed—'*The Query Editor*,' *The Practical Teacher, Pilgrim Street, Ludgate Hill, London, E.C.*

Algebra.

1. PRIAM.—Solve:—

(1) $2x-5y=3$, $x^2+xy=20$.

(2) $\frac{x^2+y^2}{x^2-y^2}=\frac{37}{12}$, $xy=48$.

(3) $2x+y+6\sqrt{2x+y+4}=23$.

$4x^2-6x=y^2+3y$.

(1) $2x-5y=3$ }
$x^2+xy=20$ }

$2x-5y=3$

$2x-3=5y$

$\therefore y=\frac{2x-3}{5}$.

$x^2+xy=20$

$x^2+x\left(\frac{2x-3}{5}\right)=20$

$x^2+\frac{2x^2-3x}{5}=20$

$5x^2+2x^2-3x=100$

$7x^2-3x=100$

$x^2-\frac{3x}{7}=\frac{100}{7}$

$x^2-\frac{3x}{7}+\left(\frac{3}{14}\right)^2=\frac{100}{7}+\frac{9}{196}$

$=\frac{2809}{196}$

$x-\frac{3}{14}=\pm\frac{53}{14}$

$x=\pm\frac{53}{14}+\frac{3}{14}$

$\therefore x=4$, or $-\frac{25}{7}$.

$y=\frac{2x-3}{5}$

$=\frac{4\times2-3}{5}$, or $\frac{-\frac{25}{7}\times2-3}{5}$

$=\frac{8-3}{5}$, or $\frac{-\frac{50}{7}-3}{5}$

$=\frac{5}{5}$, or $\frac{-\frac{71}{7}}{5}$

$\therefore y=1$, or $-\frac{71}{35}$.

(2) $\frac{x^2+y^2}{x^2-y^2}=\frac{37}{12}$ }
$xy=48$ }

$x^2+y^2=\frac{37}{12}$

x^2-y^2

$7x^2+7y^2=25x^2-25y^2$

$32y^2=18x^2$

$16y^2=9x^2$

$4y=3x$

$\therefore y=\frac{3x}{4}$.

$xy=48$

$x\times\frac{3x}{4}=48$

$3x^2=192$

$x^2=64$

$\therefore x=\pm8$.

$y=\frac{3x}{4}$

$=\frac{\pm8\times3}{4}$

$\therefore y=\pm6$.

(3) $2x+y+6\sqrt{2x+y+4}=23$ }
$4x^2-6x=y^2+3y$ }

$2x+y+6\sqrt{2x+y+4}=23$

$(2x+y+4)+6\sqrt{2x+y+4}=23+4=27$

$(2x+y+4)+6\sqrt{2x+y+4}+(3)^2=27+9=36$

$\sqrt{2x+y+4}+3=\pm6$

$\sqrt{2x+y+4}=\pm6-3$

$=3$, or -9

$2x+y+4=9$, or 81

$\therefore 2x+y=5$, or 77.

$4x^2-6x=y^2+3y$

$4x^2-6x+\frac{9}{4}=y^2+3y+\frac{9}{4}$

$2x-\frac{3}{2}=y+\frac{3}{2}$

$\therefore 2x-y=3$ }
$2x+y=5$, or 77 }

Adding, $4x=8$, or 80

$\therefore x=2$, or 20.

Subtracting, $2y=2$, or 74

$\therefore y=1$, or 37.

The values $x=20$ and $y=37$ do not satisfy the first equation.

$\therefore x=2$, and $y=1$.

Note.—(1) Each correspondent is restricted to *one* question. (2) Give the answers to your queries, and the sources from which they are obtained.

2. PICCIOLA.—Solve:—

(1) $x-y=1$, $x^2-xy+y^2=21$.

(2) $4x^2+2xy+\frac{y^2}{4}+\frac{5}{13}(4x+y)=41$,

$4x-y=4$.

(1) $x-y=1$ }
$x^2-xy+y^2=21$ }

Squaring, $x^2-2xy+y^2=1$ }
$x^2-xy+y^2=21$ }

Subtracting, $-xy=-20$

$\therefore 3xy=60$.

$x^2-xy+y^2=21$ }
$3xy=60$ }

Adding, $x^2+2xy+y^2=81$

Extracting square root } $x+y=\pm9$ }

$x-y=1$

Adding, $2x=10$, or -8

$\therefore x=5$, or -4.

Subtracting, $2y=8$, or -10

$\therefore y=4$, or -5.

$$\left.\begin{array}{l}(2)\ 4x^2+2xy+\frac{y^2}{4}+\frac{1}{13}(4x+y)=41\\ 4x-y=4\\ 4x-y=4\\ \therefore\ y=4x-4\\ \quad=4(x-1).\end{array}\right\}$$

$$4x^2+\{2x\times 4(x-1)\}+\frac{\{4(x-1)\}^2}{4}+\frac{1}{13}\{4x+4(x-1)\}=41$$

$$4x^2+8x(x-1)+4(x-1)^2+\frac{1}{13}(8x-4)=41$$

$$4x^2+8x^2-8x+4(x^2-2x+1)+\frac{1}{3}(2x-1)=41$$

$$12x^2-8x+4x^2-8x+4+\frac{10x-5}{3}=41$$

$$16x^2-16x+\frac{10x-5}{3}=41-4$$

$$=37$$

$$48x^2-48x+10x-5=111$$

$$48x^2-38x=116$$

$$x^2-\frac{19x}{24}=\frac{29}{12}$$

$$x^2-\frac{19x}{24}+\left(\frac{19}{48}\right)^2=\frac{29}{12}+\frac{361}{48^2}$$

$$=\frac{5568+361}{48^2}$$

$$=\frac{5929}{48^2}$$

$$x-\frac{19}{48}=\pm\frac{77}{48}$$

$$x=\pm\frac{77}{48}+\frac{19}{48}$$

$$\therefore\ \underline{x=2,\text{ or }-\tfrac{29}{24}.}$$

$$y=4(x-1)$$

$$=4(2-1),\text{ or }4(-\tfrac{29}{24}-1).$$

$$=4,\text{ or }4\times-\tfrac{53}{24}$$

$$\therefore\ \underline{y=4,\text{ or }-\tfrac{53}{6}.}$$

Note.—(1) Each correspondent is restricted to *one* question. (2) Why do you not send the answers to your queries?

3. SITOMAGUS.—A person has 200 coins, consisting of guineas, half-sovereigns, and half-crowns. The sums of money in guineas, half-sovereigns, and half-crowns are as 14, 8, 3. Find the number of the different coins.

Let x, y, z = No. of guineas, half-sovereigns, and half-crowns, respectively;

Then, $42x$ = Value of guineas in sixpences,
$20y$ = " half-sovereigns in sixpences,
$5z$ = " half-crowns " " ;

$$\therefore\ \left.\begin{array}{ll}(1) & x+y+z=200\\ (2) & 42x\times 8=20y\times 14\\ (3) & 42x\times 3=5z\times 14\end{array}\right\}$$

(2) $42x\times 8=20y\times 14$

$$3x\times 2=5y$$

$$\therefore\ \underline{y=\frac{6x}{5}.}$$

(3) $42x\times 3=5z\times 14$

$$3x\times 3=5z$$

$$\therefore\ \underline{z=\frac{9x}{5}.}$$

(1) $x+y+z=200$

$$x+\frac{6x}{5}+\frac{9x}{5}=200$$

$$x+3x=200$$

$$4x=200$$

$$\therefore\ \underline{x=50.}$$

$$y=\frac{6x}{5}=\frac{6\times 50}{5}=60;$$

$$z=200-(50+60)=90$$

$$\therefore\ \left.\begin{array}{l}\text{No. of guineas}=50\\ \text{" half-sovereigns}=60\\ \text{" half-crowns}=90\end{array}\right\}$$

4. MIRABILE DICTU.—Solve:—

$$\left.\begin{array}{l}x^{\frac{1}{3}}+y^{\frac{1}{3}}=1\\ x+y=19\end{array}\right\}\ \{\textit{Military (Staff College) Examination.}\}$$

$$\left.\begin{array}{ll}(1) & x^{\frac{1}{3}}+y^{\frac{1}{3}}=1\\ (2) & x+y=19\end{array}\right\}$$

$$\left.\begin{array}{ll}(1)\text{ Squared} & x^{\frac{2}{3}}+2x^{\frac{1}{3}}y^{\frac{1}{3}}+y^{\frac{2}{3}}=1\\ (2)\text{ Divided by (1)} & x^{\frac{2}{3}}-x^{\frac{1}{3}}y^{\frac{1}{3}}+y^{\frac{2}{3}}=19\end{array}\right\}$$

Subtracting, $3x^{\frac{1}{3}}y^{\frac{1}{3}}=-18$

$$x^{\frac{1}{3}}y^{\frac{1}{3}}=-6$$

$$\therefore\ \underline{xy=-216.}$$

(2) Squared, $x^2+2xy+y^2=361$

$$4xy=-864$$

Subtracting, $x^2-2xy+y^2=1225$

Extracting square root, $\left.\begin{array}{l}x-y=\pm 35\\ x+y=19\end{array}\right\}$

Adding, $2x=54,\text{ or }-16$

$$\therefore\ \underline{x=27.\text{ or }-8.}$$

Subtracting, $-2y=16,\text{ or }-54$

$$\therefore\ \underline{y=-8,\text{ or }27.}$$

$$\therefore\ \left.\begin{array}{l}x=27,\text{ or }-8\\ y=-8,\text{ or }27\end{array}\right\}$$

5. MIRABILE DICTU.—In the equation $x^3=3fx+g$, when are all the roots real? {*Military (Staff College) Examination.*}

$$x^3=3fx+2g$$

$$x^3-3fx-2g=0;$$

As the coefficient of x is negative, all the roots are real,

when $(3f)^3$ is greater than $\frac{27(2g)^2}{4}$,

" $27f^3$ " " $27g^2$,

" f^3 " " g^2.

6. SECTION.—If α and β are the roots of the equation $ax^2+bx+c=0$, find the equation whose roots are $\alpha^{-1}+\beta^{-1}$ and $\alpha\beta$. (*Certificate, 1st Year, 1877.*)

$$\alpha^{-1}+\beta^{-1}=\frac{1}{\alpha}+\frac{1}{\beta}=\frac{\alpha+\beta}{\alpha\beta};$$

Sum of roots of equation $ax^2+bx+c=0$ is $-\frac{b}{a}$,

Product " " " " " $\frac{c}{a}$;

$$\therefore\ \text{Roots of required equation}=\frac{-\frac{b}{a}}{\frac{c}{a}}\text{ and }\frac{c}{a}$$

$$=-\frac{b}{c}\text{ and }\frac{c}{a};$$

$$\therefore\ \text{Required equation is: }\left(x+\frac{b}{c}\right)\left(x-\frac{c}{a}\right)=0,$$

$$\text{" " " }x^2+\left(\frac{b}{c}-\frac{c}{a}\right)x-\frac{b}{a}=0,$$

$$\text{" " " }x^2+\frac{ab-c^2}{ac}x-\frac{b}{a}=0,$$

$$\text{" " " }\underline{acx^2+(ab-c^2)x-bc=0.}$$

7. SOLICITOR.—Find the r^{th} term of $(a^2-x^2)^{-\frac{3}{4}}$.

$$(a^2-x^2)^{-\frac{3}{4}}$$

$$=\left[a^2\left\{1-\left(\frac{x}{a}\right)^2\right\}\right]^{-\frac{3}{4}}$$

$$=(a^2)^{-\frac{3}{4}}\left\{1-\left(\frac{x}{a}\right)^2\right\}^{-\frac{3}{4}}$$

$$=a^{-\frac{3}{2}}\left\{1-\left(\frac{x}{a}\right)^2\right\}^{-\frac{3}{4}}$$

$\therefore$ The r^{th} term

$$=a^{-\frac{3}{2}}\left\{\frac{\frac{3}{4}(\frac{3}{4}+1)(\frac{3}{4}+2)\ldots(\frac{3}{4}+r-2)}{\lfloor r-1}\left(\frac{x}{a}\right)^{2(r-1)}\right\}$$

$$=a^{-\frac{3}{2}}\left\{\frac{3.\ 7.\ 11\ldots(4r-5)}{4^{r-1}\lfloor r-1}\left(\frac{x}{a}\right)^{2(r-1)}\right\}$$

$$=\underline{\frac{a^{-\frac{3}{2}}}{4^{r-1}}\cdot\frac{3.\ 7.\ 11\ldots(4r-5)}{\lfloor r-1}\cdot\left(\frac{x}{a}\right)^{2(r-1)}.}$$

8. ESSAYIST.—In what scale is 17486 written 212542?

Let x denote the radix;

Then, $2x^5+x^4+2x^3+5x^2+4x+2=17,486$;

The value of x will be found *by trial* to be 6;

$\therefore$ Scale is senary.

9. F. HOLTON.—If $m=x-x^{-1}$ and $n=y-y^{-1}$ show that $mn+\sqrt{(m^2+4)(n^2+4)}=2\left(xy+\frac{1}{xy}\right)$.

$$m=x-x^{-1}=x-\frac{1}{x};$$

$$m=y-y^{-1}=y-\frac{1}{y};$$

$$\therefore\ mn+\sqrt{(m^2+4)(n^2+4)}$$

$$=\left(x-\frac{1}{x}\right)\left(y-\frac{1}{y}\right)+\sqrt{\left\{\left(x-\frac{1}{x}\right)^2+4\right\}\left\{\left(y-\frac{1}{y}\right)^2+4\right\}}$$

$$=xy-\frac{x}{y}-\frac{y}{x}+\frac{1}{xy}+\sqrt{\left(x^2-2+\frac{1}{x^2}+4\right)\left(y^2-2+\frac{1}{y^2}+4\right)}$$

$$=xy-\frac{x}{y}-\frac{y}{x}+\frac{1}{xy}+\sqrt{\left(x^2+2+\frac{1}{x^2}\right)\left(y^2+2+\frac{1}{y^2}\right)}$$

$$=xy-\frac{x}{y}-\frac{y}{x}+\frac{1}{xy}+\sqrt{\left(x+\frac{1}{x}\right)^2\left(y+\frac{1}{y}\right)^2}$$

$$=xy-\frac{x}{y}-\frac{y}{x}+\frac{1}{xy}+\left(x+\frac{1}{x}\right)\left(y+\frac{1}{y}\right)$$

$$=xy-\frac{x}{y}-\frac{y}{x}+\frac{1}{xy}+xy+\frac{x}{y}+\frac{y}{x}+\frac{1}{xy}$$

$$=2xy+\frac{2}{xy}$$

$$=2\left(xy+\frac{1}{xy}\right).$$

10. CYMRO BACH.—Assuming that the coefficient of x^{r-1} in the expansion of $(1+a_1x)(1+a_2x)\ldots(1+a_{r-1}x)$ is the number of combinations of a_1, a_2, etc., $(r-1)$ together, find the coefficient of x^r in the expansion of $(1+a_1x)(1+a_2x)\ldots\ldots(1+a_rx)$.

Find the first three and the $(r+1)^{th}$ term of $(1-x)^{-n}$. (*Certificate*, 1883.)

Coefficient of x^r = No. of combinations of a_1, a_2, etc., $(r-1)$ together $\times a^r$

= No. of combinations of a_1, a_2, etc., (r) together.

First three terms of $(1-x)^{-n}$

$$=1+nx+\frac{n(n+1)}{1.2}x^2\ldots\ldots$$

The $(r+1)^{th}$ term

$$=\frac{n(n+1)(n+2)\ldots\ldots(n+r-1)}{\lfloor r}x^r.$$

11. BLACKBIRD.—Show that if a series of mp terms forming a geometrical progression, whose constant factor is r, be divided into sets of p consecutive terms, the sums of the sets will form a geometrical whose constant factor is r^p.

Sum of p terms, where first term $=mp$, and ratio $=r$, is

$$\frac{mp(r^p-1)}{r-1};$$

Sum of next set of p terms

$$=\frac{mpr^p(r^p-1)}{r-1},\ \text{as first term}=mpr^p;$$

$\therefore$ Sets of p terms are in geometrical progression and constant factor $=r^p$.

Arithmetic.

1. YELSSERP.—A person invests in the 3 per cents. so as to obtain interest at the rate of £2 19s. $3\frac{8}{19}\frac{8}{19}$d. per cent. per annum find the price of the stock.

£ s. d. £ £

2 19 $3\frac{8}{19}\frac{8}{19}$: 3 : : 100 : Price of stock.

20 240

59 7100

12

711

809

6399

56880

801

$57\,6\,9\,9\,9$

8

$=\frac{9}{8}\frac{9}{8}\frac{9}{8}$£

$=$£101¼. Ans.

Note.—Yes; also certificate answer.

2. TYRO.—From the first of 2 mortars in a battery, 36 shells are thrown before the second is ready for firing. Shells are thrown from both in the proportion of 8 from the first to 7 from the second. The second requires as much powder for 3 charges as the first does for 4. After how many shots will the quantity of powder consumed by the second equal that consumed by the first? (*Civil Service Arithmetic.*)

No. of shells from second mortar to equal 36 shells from first mortar $=36\times\frac{7}{8}$

$=27$;

Quantity of powder gained by second mortar over first on each discharge of second mortar

$$=\left\{1-\left(\frac{3}{4}\times\frac{8}{7}\right)\right\}\text{of charge of second mortar}$$

$=\frac{1}{7}$ of charge of second mortar;

$\therefore$ No. of shells fired from second mortar when the quantities of powder are equal

$=27\times7$

$=189$;

$\therefore$ Total No. of shells fired $=189+(189\times\frac{8}{7})+36$

$=189+216+36$

$=441$. Ans.

Note.—(1) 'How to Draw a Map,' by *A. Gardiner* (Hughes). Price 1s.

(2) 'Notes of a Course of Lectures on Commercial Geography,' by *Rev. L. C. Casartelli* (Ledsham). Price 1s. 6d.

3. HARRY.—Income tax is at present 5d. in the £, and (for smaller incomes) is levied only on the excess of a man's income over £120. After paying this tax, a man finds he has left £359 17s. 11d. What is his whole income before any deduction is made? (*Medical Preliminary Examination, Aberdeen.*)

£ s. d.

359 17 11

120

s. d. £

19 7 : 239 17 11 :: 1 : Income after deduction.

12 20

$\overline{239}$ 4797

12

$\overline{57\,5\,7\,8}$

245

$=$£245

$\therefore$ Income $=$£245 + £120

$=$£365. Ans.

Note.—Perhaps 90 per cent.

4. X. Y. Z.—If 7 men build a wall 5½ ft. high and 1½ ft. thick about a court containing 1 ac. 1 po. 29¾ yds. in 35 days of 12 hours each, and if 53 men of equal efficiency working 14 hours a day for 180 days build a wall 13¾ ft. high and 2½ ft. thick enclosing a square park, find the *area* of the park. *The area of a square is proportional to the square of the length of the side.* (*J. Brook Smith.*)

acre	pole	yards
1	1	29¼
160		
161	po.	
30¼		
4859¼		
40¼		
4900	yds.	

Side of court = $\sqrt{4900}$ sq. yds.
= 70 yds.

men		men
7	:	53
ft.		ft.
13½	:	5½
2½	:	1½
dys.		dys.
35	:	180
hrs.		hrs.
12	:	14

:: 70 yds. : Side of park.

Side of park = $\frac{\cancel{14}^{3} \times 22 \times 3 \times \cancel{180}^{2} \times \cancel{14}^{2} \times \cancel{70}^{2}}{7 \times \cancel{14} \times \cancel{6} \times \cancel{35} \times \cancel{11}}$ yds.
= 792 yds.;

∴ Area of park = $\frac{792 \times 792}{30\frac{1}{4}}$ po.

$= \frac{\overset{72}{\cancel{792}} \times \overset{72}{\cancel{792}} \times 4}{\cancel{121}}$ po.

= 20,736 po.
= 518 ro. 16 po.
= 129 ac. 2 ro. 16 po. Ans.

5. OSWALD.—Suppose a farmer has a calf, which at the end of three years begins to breed, and afterwards brings a female calf every year; and that each calf begins to breed in like manner at the end of three years, bringing forth a cow calf every year, and that these last breed in the same manner, etc.; it is required to determine the owner's whole stock at the end of 20 years. (*Bonnycastle.*)

Stock at end of 3 years = 2;
" " 4 " = 3;
" " 5 " = 4;
" " 6 " = 4+2=6;
" " 7 " = 6+3=9;
" " 8 " = 9+4=13;
" " 9 " = 13+6=19;
" " 10 " = 19+9=28;
" " 11 " = 28+13=41;
" " 12 " = 41+19=60;
" " 13 " = 60+28=88;
" " 14 " = 88+41=129;
" " 15 " = 129+60=189;
" " 16 " = 189+88=277;
" " 17 " = 277+129=406;
" " 18 " = 406+189=595;
" " 19 " = 595+277=872;
" " 20 " = 872+406=1278.

6. W. R. GATENBY.—In an election of a member of Parliament $\frac{1}{10}$th of the constituency neglected to vote, and of two candidates the one who is supported by $\frac{11}{20}$ths of the whole constituency is returned by a majority of five; find the number of votes for each.

The unsuccessful candidate is supported by
$\{1-(\frac{11}{20}+\frac{1}{10})\}$ of the constituency
$= \left(1 - \frac{38+5}{80}\right)$ " "
$= \frac{37}{80}$ " " ;
∴ $(\frac{11}{20} - \frac{37}{80})$ of the constituency = 5,
$\frac{38-37}{80}$ " " = 5,
$\frac{1}{80}$ " " = 5,
∴ The constituency = 400;
No. of votes for the successful candidate = $\frac{11}{20}$ of 400
= 190,
" " " unsuccessful " = 185.

General.

1. INFELIX.—The numbers 3 and 5 are the smallest odd prime numbers (excepting unity), and the smallest quotients give the largest divisors.

2. BLACKBOARD.—You will find one method of solution of your query in our issue for May, 1883, and another method in our issue for March, 1882.

3. FAIRLY CAUGHT.—The four pieces into which the square is divided do *not* form an oblong. The figure *appears* to contain 65 of the small squares; but if you examine it carefully, you will find that some of the squares are *incomplete*. The 64 small squares could *not* become 65.

4. E. H.—We believe you have given your query *incorrectly*. Would you please repeat it, and send (if possible) the answer?

5. R. OWEN.—(1) You will find a full reply to your query in our issue for November, 1882. (2) 'The Science and Art Directory' may be obtained through any bookseller; price sixpence.

6. DETERMINED.—Action songs of the kind you mention are rather difficult to obtain. Try 'Action Songs for Children,' by *Clifft Wade* (J. Heywood); *Miss Heerwart's* 'Songs for the Kindergarten' (Boosey and Co.), and see advertisements in the PRACTICAL TEACHER and other educational publications.

7. C. F. HAYWARD.—WHAT — WHAT, like the Latin *qua—qua*, is used for PARTLY—PARTLY. See *Abbott's* 'Shakesperian Grammar,' par. 255. Hence WHAT in this case is a correlative adverb.

8. MAGISTER.—Your query was sent by another correspondent, and the solution appeared in our *last* issue.

9. EVENTIDE.—Your query was solved in our issue for November, 1883.

10. FLOWER.—'Follow conscience, come what may.' Compare
'Faites ton devoir, advienne que pourra.'
Hence 'come' may be taken as a subjunctive or imperative, what may (come) being an adjectival clause.

11. BRIDLINGTONIAN. — *Morris'* 'Elementary Lessons in Historical English Grammar.' Macmillan and Co., 2s. 6d., page 27.

12. NANCE.—(1) No. (2) No. As to the sewing, you had better write to the Secretary of the College you intend going to. (3) No one would like to answer. Read Fitch's Lectures, and the Manuals by the National Society.

13. SCIENCE.—*Tanner's* 'Elements of Agricultural Science,' published by Macmillan and Co.; not dear.

14. LEO.—Yes, decidedly.

15. A SUBSCRIBER.—The Fifth Year's Pupil Teachers' Examination. No limit as to age.

16. QUÆSITA.—Writing, large hand and medium both need much care. Study some really good copies; 60. Small hand fairly good; 70. You cannot get an answer to your question. The 'class' is not regulated by success in one subject. Men have got high up in the 1st class who have taken no language but English; but then they have had a science or two to help them; these count for more than grammar and geography.

17. ANXIOUS ONE.—(*a*)

Sentence.	Kind of Sentence.	Conn.	Subject	Predicate.	Object.	Exten.
(*a*) The boy stood on the burning deck	Princ. S.		The boy	stood		on the burning deck (*place*)
(*b*) Whence all but him had fled	Adj. Sen. to (*a*)	*whence*	all but him	had fled		whence (*place*)

(*b*) Battersea, Chelsea, Borough Road, Westminster, Cheltenham, and Saltley, often alternate. No precise order can be given, though the foregoing may be taken as the usual order.

18. RIVER DEE.—Large hand, 40; and small hand 50 per cent.

19. ASSISTANT.—Yes. Number one, 40; number two, 45; both bad.

20. B. M. TRAPP.—*Deschanell's* 'Natural Philosophy Volume on Sound and Light,' or any good book on acoustics.

21. H.—The papers will all be published as they were read, and will shortly be for sale.

22. LIZZIE.—

Sentence.	Kind of Sentence.	Conn.	Subject.	Predicate.	Object.	Ext. of Pred.
(a) But my soul wanders	Princ. S.	But	My soul	wanders		
(b) I demand it back to, etc.	Princ. S. co-ord. with (a)		I	demand	it, to meditate amongst decay and stand a ruin amidst ruins, there to track fallen states and buried greatness o'er a land	back
(c) which was the mightiest	Adj. Sent. to (b)		which	was the mightiest		in its old command
and is the loveliest	Adj. Sent. to (b)	and	(which)	is the loveliest		
(d) and must ever be	Adj. Sent. to (b)	and	which	must be (the loveliest)		ever
(e) (It is) the master-mould of Nature's heavenly hand	Princ. S.		It, *i.e.*, the land,	is the mastermould of Nature's heavenly hand		
(f) Wherein were cast the heroic and the free, the beautiful, the brave, the lords of earth and air.	Adj. Sent. to (e)		The heroic, and the free, the beautiful, the brave, the lords of earth and air	were cast		wherein

23. 1ST B.A.—If the angle be given, the sin, cos, and consequently the tan, can be found from the Trigonometrical Tables of Natural Sines and Cosines. Consult *Chambers'* 'Mathematical Tables.'

The sin, cos, etc., of angles of 15°, 30°, 45°, 60°, 75°, etc., are given in works on Plane Trigonometry.

24. FRED.—We do not, at present, intend to continue the Lessons. Write to Messrs. Sonnenschein and Co. for a prospectus of the Rev. E. Fowle's Latin Books. They are excellent.

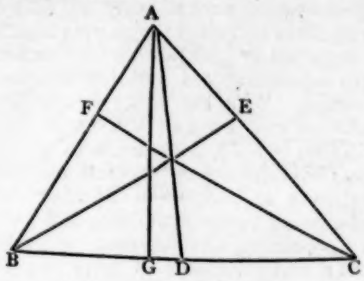
Geometry.

1. BOLDMERE.—Show that three times the sum of the squares on the sides of a triangle is equal to four times the sum of the squares on the lines drawn from the vertices to the middle points of the opposite sides. (*2nd Stage Mathematics*, 1884.)

Let ABC be a triangle, and let the three straight lines AD, BE, CF be drawn to the middle points of the opposite sides.

Then, $3(AB^2+BC^2+AC^2)=4(AD^2+BE^2+CF^2)$.

Draw AG perpendicular to BC.



Proof.—$AB^2=AD^2+BD^2-2BD.DG$, (II. 13.)
$AC^2=AD^2+CD^2+2CD.DG$, (II. 12.)
$\therefore\ AB^2+AC^2=2AD^2+2BD^2$; (Ax. 2.)
$2(AB^2+AC^2)=4AD^2+4BD^2$
$=4AD^2+BC^2$;

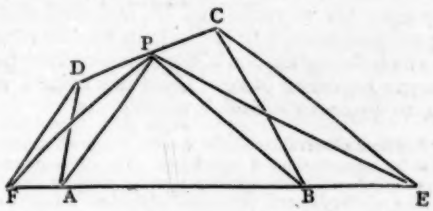
Similarly,
$2(AB^2+BC^2)=4BE^2+AC^2$,
$2(AC^2+BC^2)=4CF^2+AB^2$;
$\therefore\ 4(AB^2+BC^2+AC^2)=4(AD^2+BE^2+CF^2)+AB^2+BC^2+AC^2$,

Wherefore $3(AB^2+BC^2+AC^2)$
$=4(AD^2+BE^2+CF^2)$. (Ax. 3.)

Q. E. D.

Note.—Messrs. Longmans and Co., Paternoster Row, E.C., publish an excellent work on the subject.

2. E. H. COUMBE.—ABCD is a given quadrilateral: construct a triangle whose base shall be in the same straight line as AB, vertex at a given point P in CD, and area equal to that of the given quadrilateral. (*Todhunter.*)



Join PA, PB. Through C draw CE parallel to PB, and meeting AB produced at E.

Through D draw DF parallel to PA, and meeting BA produced at F.

Join PF, PE.

Then PFE shall be the triangle required.

Proof.—$\triangle PEB=\triangle PCB$, (I. 37,)

And $\triangle PFA=\triangle PDA$; ,,

$\therefore\ \triangle PFE=$Quadrilateral ABCD.

Q. E. F.

*** *Many Queries are unavoidably held over.*

The International Conference on Education.

THE International Conference on Education, recently held in connection with the Health Exhibition, was a remarkable and notable gathering, and reflects much credit upon Lord Reay, the President, and his colleagues, the members of the Committee. Never before, perhaps, was brought together such an array of educational talent, and certainly on no previous occasion have the various phases of educational thought been so clearly, fully, and forcibly presented to the public mind. Scarcely a branch of popular instruction was left untouched. University training, the education of women, physical educational, technical education, art education, the various branches of elementary education down to the Kinder-garten, free

education, compulsory education, school buildings, and school hygiene were all freely and fully discussed. Papers on these and other topics were read by experts most competent to give reliable information thereon, and most interesting and valuable debates arose in every section. With the space at our disposal it is impossible to give even an outline of the proceedings. All we can do, therefore, is to present to our readers a few of the prominent points discussed, leaving them to study at leisure the full report which will shortly be issued by the authorities of the exhibition.

The Conference was fortunate in having for its president a man so capable in every respect as Lord Reay. Of him it may be said even more truly than of Cobden, that he is an 'international' man; and this, combined with his wide knowledge and high intelligence, pre-eminently fitted him to preside over an International Conference on Education. Though known to English public life for a comparatively short period of time, Lord Reay has, since his appearance as President of the Social Science Congress in 1880, rapidly made his way to the front rank as an educationalist and social reformer. His opening address was in many respects a remarkable one. With the Lord President in the chair, and surrounded by a galaxy of educational notabilities, among whom were the American Minister, Mr. Mundella, and the Chairman of the London School Board, he delivered an inaugural address which was as brilliant as it was erudite and comprehensive. Taking his tone naturally from his surroundings, he indicated that a new departure was about to be made in English education, in which the cultivation of the observing faculty would have an important place. Upon this point it may be well to quote his lordship's words:—

'Constant observation of the various forces which are operating is the main element of education. The development of the powers of observation to satisfy an ever-expanding curiosity is at the root of every system of rational education. How to observe, and what to observe, in the past and in the present, is the ever-recurring function of education through life. Apply the test to the humblest and to the most exalted professions, you will see that the test does not fail. The agricultural labourer, whose work is of the most interesting description, will be efficient or inefficient, exactly in proportion as his faculty of observation has been developed. Nature will teach him something every day of his life, if he has been taught how to watch her workings. It is the same for the astronomer; observation is to him the first necessity. In primary education, this truth is more and more recognised; and drawing, as well as elementary science and manual work, are being put in their proper places. Belgium is moving vigorously in that direction, following, with reference to manual work, Sweden, where the *slöjd*, or school of domestic industry, may well claim our attention. Two French Ministers of Education, M. Bardoux, and the present Premier (M. Ferry), have given their verdict in favour of the extreme importance of drawing. Sweden also contributes to gymnastics that efficiency of training which—as we are so near to hygienics—I need only indicate with a word. The monopoly of the three R's is doomed, and the enthronement of the three D's—drawing, drill, and adroitness—approaching. The primary school must not degenerate into a mere workshop. I do not agree with the Procureur-Général de la Chalotais when he complained of the subversive influence of the Jesuits in teaching children to read and write, who ought only to learn how to handle a hammer or a plane. In pleading for rational being substituted for mechanical methods, I simply desire to rouse inquisitive tendencies, which, in many cases, now are deadened: to make the primary school, not the early grave of individuality, but an attractive spot where the productive use of leisure as well as of the hours devoted to work, coupled with the surroundings of prints and flowers, shall give pleasure to the boys and girls who frequent it.'

He agreed that through technical education we must recover the ground lost since the Middle Ages, when, in Italy at least, an artizan was an artist. There must be a large increase of schools with a modern curriculum. His lordship protested against too much centralisation in education, and viewed with some suspicion the idea of a Minister of Education. He thinks, that 'if every nation were to give full play to the variety of talents which it contained, instead of trying to press their schools into one mould, we should hear less complaint of want of originality.' The Universities were called upon to take their share in the coming reforms. If they gave us our lawyers, our doctors, our statesmen, our clergy, and our literary men, why should they not give us the best engineering, financial, agricultural, and commercial skill? He urged that the University of London should become a teaching university, and that the Technical College should be affiliated to it. We cannot better conclude our notice of Lord Reay's address than by giving the following quotation:—

'Such complex machinery as modern society, with its manifold wants, makes the organisation of education more complex every day. Not by centralisation, not by programmes, not by circulars, not by examination papers, not even by lavish expenditure alone will success be attained. What is wanted is that public spirit, that strong conviction in every man, woman, and child, that education is a privilege; that the more education a man has the more he is to be respected. Does it exist? Yes, you will find among the scattered population of the Highland glens of Scotland and of Switzerland, along the canals of the Netherlands, in the forests of Germany. It is a precious heritage. To increase it is our object. The great Chancellor of the German Empire once compared the struggle for gold between the central banks of Europe to a struggle among individuals for a blanket of insufficient size. The same process is at present going on in various States of Europe with reference to education. We are all struggling for golden wisdom, with this great difference, that the gold we bring to the surface at once becomes the property of all. The discoveries of the biological marine station at Naples can be tested at St. Andrews, and the scientific work done at Strasbourg can be utilised in Edinburgh. Science cannot render men equal. The princes of science constitute a separate order, and when we enjoy the pleasure of contemplating or reading the works of genius, we cannot help admitting our own inequality. A nation ceasing to reverence its great men is on the decline. Inequality is a law of nature; but so is liberty, and liberty is incompatible with equality. But if education alone makes liberty possible, by learning its uses and preventing its abuses, it also teaches us to be generous. The best educated man will also have the widest sympathies. The best educated people will also be the people which cements peace and goodwill among nations.'

The international character of the Conference will be seen from the list of foreign representatives who were entertained at the Mansion House Banquet by the Lord Mayor, M.P. The five Departments of the French Ministry of Public Instruction were represented by sixteen delegates, and no less than eleven upheld the honour of Belgium. Austria and Saxe Weimar sent representatives, as did also Russia, Spain, Denmark, Holland, Switzerland, The United States, Brazil, and Japan. The able speeches of Messieurs Buls (Burgomaster of Brussels), Buisson (Director of Primary Instruction in France), Lanholt (Inspector of Secondary Schools in Berne), and other foreign delegates, gave a completeness and breadth to the discussion which was most satisfactory.

After the inaugural address, the work of the Conference was transacted in four sections. In Section A, most of the proceedings had reference to Elementary Education, and during the greater part of the Conference this section attracted the largest attendance. Papers on the 'Structure, Fittings, and Equipments

of a School' were read by the Vice-chairman of the Birmingham School Board and others.

The discussions in Section A on Tuesday were of a highly interesting character, the subject being 'Infant School Education.' Mr. Fitch presided, and papers were read by Miss Manning on 'What Fröbel did for Young Children,' and by Fraulein Heerwart on 'The Kinder-Garten in Relation to the various Industrial Products of a Country.' A paper promised by Madame Schrader, of Berlin, was not forthcoming. The advocates of the Kinder-Garten system had quite a field-day, the papers being thoughtful and judicious. Mr. Fitch closed the discussion in a careful and temperate speech, which was not marred by the extreme and fantastic enthusiasm of many of those who speak of Fröbel and the Kinder-Garten without any real appreciation of the true spirit which animated him and his work. In the afternoon Mr. Woodall, M.P., presided in this section, when the following papers were read: 'Infant Schools under the Code of 1884,' by Mr. A. Bourne: 'The Apparatus Needed for Play and Instruction,' by Miss Ellis; and 'Infants' Schools in France,' by Madame Dillon, Inspectress of Infant Schools in France. A demonstration lesson was afterwards given to a class of infants by Fraulein Heerwart in room No. 12. Here we found the true teacher shining orth in every word and action of the demonstrator, and we came away confirmed in our belief that it is not a 'system' that we require, but Fröbels and Heerwarts.

On Wednesday this section was presided over by the Vice-President of the Council, when a trenchant paper was read by Mr. Heller, of the London School Board, on the 'Organisation of Elementary Education.' In this paper Mr. Heller, while acknowledging the enormous advance made during the past thirty years, points out the principal defects in the present educational arrangements of the country, and indicates certain reforms. He stated that 'the system of remitting fees in the Metropolis was doing more to encourage hypocrisy, and to demoralize the working classes, than any recognised system of free schools could possibly do.' He argued that the system of training teachers should be so modified that teachers 'should obtain their general education in the same manner, and to the same liberal extent, as the lawyer, the doctor, and the divine,' and that the Training Colleges should be affiliated to the Universities and made more strictly professional in their work and functions. An interesting historical sketch of Primary Education, read by the Rev. H. Roe, calls for no special comment. The discussion which followed was animated and instructive. Mr. Mundella, as became the official head of the Education Department, took a more roseate view of matters educational than did Mr. Heller, and he demurred to the conclusions at which the latter had arrived from the Department's statistics on school attendance. The Vice-President then ventured into Utopia, and sketched an ideal condition of education in England. He agreed with most of the reforms sketched out by Mr. Heller, but he feared it would be a long time before they could all be realized.

During the discussions in Section A, it was curious to note how nearly every speaker reverted to the question of 'Overpressure in Education.' Mr. Heller had barely referred to it, having apparently studiously avoided introducing a confusing element into the question of 'Organization.' Mr. Sydney Buxton, M.P., however, rushed into a controversy on overpressure, which had nothing to do with the question before the Conference, and about which the honourable gentleman did not appear to be very well informed. Miss Edith Lupton, of Bradford, followed the same lead, and spoke in her characteristically fervid and fluent style, which seems to have completely defeated the frantic efforts of the reporters to keep pace with her utterances. So keen was the interest taken in this discussion, that the Section resumed it in the afternoon instead of devoting the time, as had been intended, to a half holiday. Messrs. F. White, Collins, Kennedy (Glasgow), and others took part in the proceedings, as did also Mons. Buls, of Brussels, who read a paper on 'Conditions of Healthy Education.' In moving a vote of thanks to Mr. Mundella, Mr. Heller caused some amusement by referring to 'the very conservative tone of the Vice-President's remarks.'

In Section B the subject of Technical Education was dealt with. Mr. Mundella presided on Monday, when Mr. Philip Magnus, one of the Commissioners, delivered an introductory address. Mr. E. M. Dixon, of the Allan Glen's Institute, Glasgow, read a paper on 'Workshop Instruction in Technical Schools,' and Mr. J. F. Moss expatiated on 'Technical Teaching in Board Schools.' The former paper described how technical and scientific instruction were combined in the Allan Glen's Institution, and indicated some of the results of the teaching, which were further illustrated by the models made by the scholars and shown in the Health Exhibition. Mr. Moss described an experiment tried in the Central Higher Board School, Sheffield, and his communication was full of interesting and accurate information. A paper on 'Manual Training Schools,' by Professor Woodward, of St. Louis, was circulated, but not read. A general agreement seemed to exist that some manual training was desirable, but the speakers differed greatly as to how far such teaching could be introduced into the primary school. The remarks of Mr. Park and of Mr. Woodall were eminently practical, and were in the direction of not too soon disturbing and specialising the general education of the scholars. On Tuesday Prof. Armstrong opened a discussion on 'Instruction in Chemistry,' and Professor Garnett read a paper on 'Technical Education.' A very animated discussion followed, in which the work of the Science and Art Department was criticised, and the system of 'Payment by Results' was condemned. In the afternoon Mr. Harrison, of Birmingham, gave an account of 'A New Method for the teaching of Science in Public Elementary Schools.' The method is a very simple affair, and consists of an itinerant lecturer and a locomotive laboratory. The cost is shown to be comparatively small, and we have no doubt that much good scientific instruction may be thus provided. But we agree with Professor Armstrong that 'if science is to be taught at all, it must be done seriously.' If it is taught peripatetically, the instruction can never become practical. Mr. H. A. Reatchlous, of the Westminster Training College, read a paper on 'Science Teaching in Training Colleges,' in which he defended those institutions from the charges of inefficiency which the Commissioners had brought against them. He pointed out with perfect fairness and much force: (1) That science can only be taught in training colleges as one of many equally important subjects.

(2) That sound elementary instruction is being given in these institutions at the present time. (3) That the success of the students in chemistry, and especially in practical chemistry, is inconsistent with the judgment expressed by the Commissioners on page 526 of their report. (4) That further improvement must be sought in giving the men greater inducements to work practically at the subject themselves, and study phenomena at first hand. The discussion which followed did not in any degree shake the position taken up by Mr. Reatchlous.

The teaching of cookery was dealt with in the same section by Miss Fanny Calder, and a very interesting discussion followed. On Wednesday the section was devoted to art. Mr. Sparkes, of South Kensington, Mr. Ablett (London School Board), and Mr. Brophy (Finsbury Technical College), read papers on 'The Teaching of Drawing and Colouring as a Preparation for Designing and Decorative Work.' The papers contained very valuable suggestions, which will bear fruit in the future. Perhaps no men could have been found more competent to propound opinions on this subject, which is so closely connected with our manufacturing interests. Mons. Couvrier, on behalf of M. Germain, read a paper 'On the Teaching of Domestic Economy and Needlework,' in which, while declaring that 'it is a great mistake to turn primary schools into technical schools for preparing children for various trades,' he advocated distinct teaching in domestic economy and needlework.

We would willingly extend our notice to the work of the other sections, in which the 'Training of Teachers' and 'University Education' were dealt with, and similarly, we should much like to notice the excellent paper by Mr. Fitch on 'The Examination and Inspection of Schools,' but the pressure upon our space forbids. We may be able to return to the subject on a future occasion, and thus place before our readers a complete resumé of the proceedings of this memorable conference. The transactions, when published, will be a source of constant reference, and will furnish for some time to come a valuable amount of information on current educational topics. We trust the success of the conference may lead to similar meetings at no far-distant date. The arrangements made by Mr. Cowper, the Secretary, were excellent.

The Discipline of the Mind.

BY W. C. COUPLAND, M.A., B.SC.,

Lecturer on Mental and Moral Science at Bedford College, London.

V.—IMAGINATION.

THE due control of Imagination is not the least difficult of educational problems. In no part of the mental economy is the golden mean so important to attain or so easy to miss. For, on the one hand, an active imagination is the mainspring of spiritual progress, on the other an unseasonable and too luxurious fancy infallibly relaxes moral fibre, and dims the clear eye of reason.

There is both truth and error in the vulgar opinion that Imagination is most brilliant in the infancy of the individual and the race. There is truth in the statement in so far as the mental picturing of individual wholes precedes the power of framing general conceptions. The logic, it has been said, of animals and of young children is that of Images; by which is meant that the earliest associations are formed between concrete wholes, as given in sensuous experience, and that these spontaneous associations dominate the spiritual life, until the individual has acquired the power of arbitrary selection and rejection among the constituents of consciousness. Perception, Imagination, Conception, are the three stages of conscious life. The first reaches back to the very dawn of animal existence, the second marks out the 'higher' animal, the third is characteristic of Man. Now, as the order in which faculty has been evolved is an order determinative of its future manifestation, a scientific discipline should give heed to the hints of spontaneous growth, and further the unfolding of each power in its season.

But it will be well at once to rightly understand the force of this term 'Imagination,' for its ambiguous employment has been the source of much theoretical, if not practical, confusion. There are, indeed, two senses partially opposed to each other in which it is employed; it being equivalent either to the internal re-view of a concrete whole after the object has been withdrawn from direct perception, or to the rearrangement of the elements of former experiences, with a view to the satisfaction of some particular emotion. Now it is when employed in the former sense that the assertion is correct that primitive peoples are highly imaginative, more imaginative even than the civilised moderns. And naturally so, for not having acquired the art of condensing a vast host of particulars into the unity of a general idea—an art requiring the aid of conventional symbols, as words or written signs—the retention of serviceable knowledge necessitated in early times the constant inner visualizing of the past, and a pictorial memory was essential even to self-preservation. The same rule of procedure obtains in the development of the young child. The will being yet non-existent or embryonic, the child can think only by media which require no effort for their production, and which are little else than the pale traces of its fuller life. Accordingly it is all-essential that the thought-images should be *faithful*, that is, that they should truly represent what erewhile was direct, sensuous presentation. With many this power will need no assistance; the actual scenes will be so sharply photographed, as it were, upon the sensitive plate of the brain, that a very weak illumination of the interior light will enable the idea to be realized in almost its original brilliancy. In other cases, however, the faculty will have to be assisted; when either the representative power itself is fundamentally weak, or the internal stimuli to its exercise are few and of low intensity.

Now, when it is said that early nations are most imaginative, that the present age is un-ideal, that the fancy of children is superior to that of adults, the assertion can only be allowed to pass if held to mean, that the reproductive or pictorial imagination occupies a larger relative space in the life of certain periods than other modes of mental activity, and that as time goes on the 'Logic of Signs' comes to supersede the Logic of Sensuous Images. But it would be erroneous to use this language of that other species of Imagination, where the activity of the mind is occupied in framing conceptions which are not abstracted from the superficial aspects of the real world. In *this* sense savage

races and youthful minds must, on the contrary, be pronounced highly unimaginative, for the want of this power is probably the main reason why the life of primitive generations revolves in so monotonous a round, and why the old head is not found on the young shoulders. For it is implied in this other and higher sense of imagination that the mind at a certain stage has a power not only of re-casting objects and scenes once beheld, but of penetrating beneath the surface of things, and of putting itself in the position of people whose modes of consciousness it has no means of directly gauging, which again requires a very large experience and a great diversity of social life.

We must, then, clearly distinguish these two varieties of the imaginative faculty, or we shall be led astray in our disciplinary methods, and endeavour to produce results which by the nature of the case are unattainable.

Having uttered this preliminary word of warning, however, I am by no means disposed to lay an extreme stress upon the distinction just drawn. The *reminiscent* and the *re-constructive* imagination are after all not easily divisible, and in the actual operations of consciousness it is the rule rather than the exception to find them in combination. Thus the shaping hand of Art interferes with the simple flow of spontaneous association, and a certain transposition of the details may falsify what seems the simple revival of the bygone. We see the germs of a tendency to transcend the actual in the spontaneous manifestation of the 'play-instinct.' Here the incidents which have excited wonder or admiration, but which, perhaps, have been no part of the child's own active life, are on the first opportunity enacted in the play-theatre, and that selectiveness which is characteristic of Art in all its forms is exhibited in the pigmy mimicry and dramatization of the infant's æsthetic world. An equally good example would be the strong tendency to 'day-dreaming' exhibited by many youthful minds, where, out of a very small stock of actual experiences, the mind goes on to construct pictures and work up scenes more gorgeous than anything it is ever likely to behold with the bodily eyes.

Now what must be said with regard to this splendid power in an educational point of view is this, that both forms of imagination, the reproductive and productive, are to be cultivated to the highest pitch, but to be kept to their places, and held to do work which is profitable to the life of the human being *as a whole*. As the variety of actual experience open to the most favoured human being is after all insignificant compared with possible experience, a power of rapidly utilizing the few forms of actual experience vouchsafed it, to construct a world beyond the reach of personal perception, is the prime condition of intellectual growth. And the forms of existence being so varied, it is extremely improbable that a power of imagination in all directions will be possessed by any mind. There will always be some direction in which the ability to call up mental pictures will be weak. There is a spontaneous constructive power in all, which should be detected by the educator, desirous of estimating the bent of character with a view to proportioning discipline to power. Imagination as concrete memory runs in channels pleasing to the individual, and to see the drift of the current we must watch its subtle windings in recreative moods, when the mind is abandoned to itself, and no constraint is imposed from without. What dreams are to the individual desirous of self-knowledge are the trivial games and sports of fancy to the philosophic educator and the possible successes and perils of the future may be read by a discerning eye in both.

There may be said here what admits of application to the whole range of mental culture, that not *repression* but *direction* is the *rôle* of the scientific educationist. The Imagination cannot be too active, if only it be an imagination which furthers the real work of life. The misfortune, however, is that many of tis manifestations are hostile to the welfare of the individual and of society. There is no harm, nay, there may be much good in stimulating the imagination of very young minds by stories of impossible triumphs over physical obstacles and of feats of unlimited personal prowess. Human nature speedily gravitates to a low estimate of its capacity, and needs to be roused by ideals of excellency rising above the actual environment. Fiction, if merely transcending not distorting the actual, whilst with some a spontaneously sought indulgence is for others a needed incentive. The fairy-tale and the romance are aids to culture which only a narrow-souled disciplinarian, confounding matter-of-fact truth with truth of life, will despise. Now Nature bends to the touch of mind, and man is bidden to have courage in presence of the dark fate which seems at the first blush utterly to enfold him; now the fairest hopes and most cherished desires of the heart attain a fruition which, if illusory, counts for much as a spur to strenuous exertion.

But the mind having had its dream of beauty, the careful trainer will see to it that the dream does not outlast the hour of repose, and will supply more practical material for the plastic energy of the working-day. The difference between the Imagination which enervates and unstrings the powers, and the Imagination that gives breadth and grasp of truth, lies in this, that the former is a mere revelling in the pleasing aspects of things superficial in obedience to the associative impulse alone, the latter is a synthesis born of deep-seated emotion, following on a genuine analysis. In the one case we are at the mercy of our fortuitous associations, the combinations are like dissolving views, gladdening for the moment, but becoming no part of our spiritual fabric; in the other they are extensions of common life, which we ourselves have helped to fashion. It is immaterial to what department of mental activity we turn, what the nature of the constructions may be, if they are to enrich us and to add to our power they must be the result of an *active* synthesis, they must be truly original in the sense of being the outcome of a vital will. This holds true even of Art strictly so called. No work of Art has ever powerfully affected mankind where hard labour has not been spent in mastering the elements which enter into the composition, where there has not been a synthesis, the secret springs of which perhaps are hidden, but which has its source in the core of the artist's own soul. Where there is not this personal activity the production may be rich in conceits of fancy, but will leave the spectator unmoved. But the world of Imagination must of course not be limited to the artistic sphere; its exercise is just as much required, and just as evident, in the region of practice or in the realm of pure theory. A high constructive imagination, the power, that is, of rising out of the rut of routine, of bringing experience to bear upon

novel situations, of devising new methods to cope with emergencies, is a faculty which has no slight scope for its exercise in every-day affairs; and the *scientific* imagination may claim at least equality with that which forms the glory of the poet. Few ideas, indeed, are more mistaken, and may prove more mischievous, than the notion that Imagination is either a useless or a frivolous exercise of mind. Not useless, for it is the lack of it that condemns a mind or a nation to spiritual and material stagnation; frivolous only when divested of a high purpose.

(To be continued.)

—o—

Chemistry of the Non-Metallics.

BY EDWARD AVELING, D.SC. LONDON.

[This series of articles, whilst dealing with the subjects required by the University of London for the Matriculation Examination and with those required at the Elementary Stage of the Inorganic Chemistry (Branch X.) Science and Art Department, is intended as a practical guide to the philosophical and systematic study of the non-metallics.]

EXAMPLES ON THE FORMATION OF HYDROGEN FROM WATER AND POTASSIUM OR SODIUM (*for Solution*).

(21) Required 7 grams hydrogen. What weights of water and sodium must be taken? .....126 and 161 grams.

(22) What weight of water will 2 grams of potassium decompose? ....$1\frac{1}{2}$ grams.

(23) 9·2 grams sodium are thrown on water. What weight of hydrogen is evolved? .....$\frac{1}{5}$ gram.

(24) What weight of caustic potash can be formed from 1 litre, 8 hectolitres of water? .....

3 kilog. 7 hectog. 3 decag. $3\frac{1}{2}$ grams.

EXERCISES (*Solved*).

(32) 5·6 litres hydrogen are required. What volume of water and what weight of sodium are needed? .....

22·4 litres H. require 36 grams = 36 cc. H^2O + 46 grams Na.

1 ,, requires $\frac{36}{22\cdot4}$,, = $\frac{36}{22\cdot4}$,, ,, $\frac{46}{22\cdot4}$,, ,,

5·6 ,, require ,, ,, = $\frac{36\times5\cdot6}{22\cdot4}$,, $\frac{46\times5\cdot6}{22\cdot4}$,,

9 grams water, $11\frac{1}{2}$ grams sodium.

(33) 7·8 grams potassium are given you. What volume of hydrogen can be obtained by the action of these upon water?

With 78 grams K. 22·4 litres H. can be obtained.

,, 1 gram ,, $\frac{22\cdot5}{78}$,, ,, ,,

,, 7·8 grams ,, $\frac{22\cdot4\times7\cdot8}{78}$,, ,,

2·24 litres.

EXAMPLES (*for Solution*).

(25) 800 cc. hydrogen are required. What weight of sodium must be taken? .....$1\frac{9}{25}$ grams.

(26) From $\frac{1}{2}$ litre of water what volume of hydrogen can be obtained? ....$311\frac{1}{9}$ litres.

From the experiments of water and sodium or potassium another general truth may be learned. By reference to page 260, the student will see that whilst the water before the metal was thrown upon it did not affect either the red litmus paper, the blue litmus paper, or the yellow turmeric, after the experiment the blue litmus paper was still unaffected, the red was turned blue, and the yellow turmeric paper brown. These changes are due to the action on the vegetable colours of the potassium hydrate or sodium hydrate formed in the reaction. Each of these compounds has the power of turning red litmus paper blue, and yellow turmeric paper brown. Bodies possessing this power are called alkalies. Their solutions are spongy to the touch. This can be rectified by feeling the water in the trough, after the potassium or sodium has been thrown into the water.

If three similar pieces of paper are placed in sulphuric acid the blue litmus paper is turned red, and the others are not affected. Bodies possessing this power are called acids. Their solutions are sharp to the taste.

If a solution of caustic soda or potash and the sulphuric acid are mixed together carefully with frequent testing by litmus papers, it is found that they neutralise the action one of the other, and that at last a solution is formed that is neither alkaline nor acid. That solution contains a salt, sodium or potassium sulphate.

$$\underbrace{2\ Na\,H\,O}_{80} + H^2\,S\,O^4$$
$$\underbrace{2\,(23+1+16)}_{80} + \underbrace{2\times1+32+4\times16}_{98}$$
$$= \underbrace{Na^2\,S\,O^4}_{142} + \underbrace{2\,H_2\,O}_{36}$$
$$= \underbrace{2\times23+32+16\times4}_{142} + \underbrace{2\,(2\times1+16)}_{36}$$

$$\underbrace{2\,K\,H\,O}_{112} + H^2\,S\,O^4 = K^2\,S\,O^4 + 2\,H^2\,O$$
$$\underbrace{2\,(39+1+16)}_{112} + (2+32+64) = 78+32+64 + \underbrace{2\,(2+16)}_{36}$$
$$112 \qquad 98 \qquad 174 \qquad 36$$

THIRD PREPARATION. FROM WATER BY ELECTRICITY.

(1) *Laboratory Method.*—Place in a pneumatic trough a quantity of water; and add a few drops of sulphuric acid to the water. Arrange two gas-jars inverted and filled with the acidulated water upon two beehives. Attach to the two end plates of a Grove's battery two copper wires. To the wire attached to the platinum plate of the battery affix, at its free end, a piece of platinum foil. The reason for doing this is that the gas, oxygen, that will be given off at this wire will combine with the copper wire, and not be liberated. Place the free ends of the two wires in the acidulated water, and slip them through the side apertures under the beehives upon which the inverted gas-jars are standing. Bubbles of gas are slowly disengaged at each wire-end. The water is decomposed; the gas which comes off at the end of the wire connected with the zinc plate of the battery is hydrogen.

This experiment introduces us to the electrical relationships of chemical compounds in general, and of water in particular. Every chemical compound is made up of two groups, sometimes consisting of one element, sometimes of more than one. Of these two groups one is electrically positive, the other electrically negative. In the case of water the hydrogen is positive, the oxygen negative. By a well-known law of electricity, bodies electrified in opposite ways attract; bodies similarly electrified repel one the other. The free end of the wire connected with the zinc plate is electrically negative, and therefore at it the positive hydrogen comes off. The free end of the wire connected with the platinum plate is electrically positive, and therefore at it the negative oxygen comes off.

As in water there are, as the symbols of that compound remind us, two parts by volume of hydrogen to one of oxygen, the jar above the negative wire-end or pole ought to fill twice as rapidly as that over the positive pole. But this is not what occurs. For oxygen gas is much more soluble in water than in hydrogen, and a great deal of the oxygen that comes off is dissolved by the water and does not rise into the jar.

(2) *Symbols.*—$2(H^2O) = 2H^2 + O^2$.

(3) *Weight-numbers and volumes.*—$36 = 4 + 32$.
4 vols. 2 vols.

That is, 36 parts by weight of water under electroloyis (electrical decomposition) yield 4 parts by weight or 4 parts by volume of hydrogen, and 32 parts by weight or 2 by volume of oxygen.

This is the analytical method of determining the composition of water: ἀνα (ana) = up; λυω (luō) = I free. Analysis is the breaking up of a compound body into simpler bodies.

EXERCISES ON THE ELECTROLOGIS OF WATER (*Solved*).

N.B.—Weight and volume questions will not be combined.

(34) What weights of hydrogen and of oxygen respectively will be evolved in the electrolitic decomposition of 4 cc. of water?

1 cc. H^2O weighs 1 gram.
4 ,, ,, weigh 4 grams.
36 grams H^2O yield 4 grams H, 32 grams O.
1 gram ,, yields $\frac{4}{36}$,, ,, $\frac{32}{36}$,, ,,
4 grams ,, yield $\frac{4\times4}{36}$,, ,, $\frac{32\times4}{36}$

$\frac{4}{9}$ gram hydrogen, $3\frac{5}{9}$ grams oxygen.

(35) Required 10 cc. hydrogen. What weight of water must be taken?

11·2 litres hydrogen = 11200 cc.
$4\times11{\cdot}2$,, ,, = 44800 cc.
44800 cc. ,, ,, = yielded by 36 grams H^2O
1 cc. ,, ,, ,, ,, $\frac{36}{44800}$,, ,,
10 cc. ,, ,, ,, ,, $\frac{36\times10}{44800}$,, ,,

$\frac{1}{1245}$ gram.

(35*a*) 1 hectogram, 6 decagrams oxygen are evolved by the electrolitic decomposition of water. Find the volume of hydrogen given off, and the weight of water decomposed.

1 hectogram, 6 decagrams = 160 grams.

32 grams O are given off when $4\times11{\cdot}2$ litres H are evolved from 36 grams H^2O.

1 gram O is given off when $\frac{4\times11{\cdot}2}{32}$ litres H are evolved from $\frac{36}{32}$ grams H^2O.

160 grams O are given off when $\frac{4\times11{\cdot}2\times160}{32}$ litres H are evolved from $\frac{36\times160}{32}$ grams H^2O

224 litres hydrogen, 180 grams water.

(*To be continued.*)

—o—

Publications Reviewed.

Natural History Readers for Standards IV. and V. By the Rev. J. G. Wood. London: William Isbister, Limited.

In the case of an author who has devoted his life to the study of his subject, and has written over a dozen successful and valuable books upon it, a reviewer can have but little to say in criticism of a new work, considered either as science or literature. To remark that Mr. Wood understands natural history, and can write about it in a bright, brisk fashion, with his topic well in hand, and all its details duly marshalled, is only to say what 'goes without saying.' Our criticisms upon these Readers must be confined to their suitability as school books for the standards for which they are designed.

From this point of view, both volumes, but especially the one for Standard IV., are open to two observations. The first is that the vocabulary is too easy for the standard; the second that the matter is too full of detail. The first point will be less an objection with teachers than with Her Majesty's inspectors; and our attention was, in fact, drawn to the matter by the knowledge that a London inspector had taken exception to the use of Mr. Wood's earlier standards on this ground. The second is the more important point for the teacher. It makes the book a difficult one indeed, if all the vast variety of detail that is given here is to be even approximately memorised by the children.

This, of course, does not apply if the work is used merely as an extra reader, but only if it be taken as the base of a class-subject examination. In the latter case, however, the work of teaching the innumerable small details of difference between animals that are given here at such full length, and yet in such concise phrase, will be tremendous. In fact, it will be an impracticable task; and as the 'animal life' topic is only one branch of the elementary science subject, the impossibility of really utilising Mr. Wood's book in teaching it is increased.

We will illustrate our meaning by taking one group of animals at random. Here, for instance, is the section of the Standard IV. volume on 'Ruminants.' It occupies (excluding pictures) about thirty-two pages, and in that space we find condensed the anatomy of the stomach of ruminating animals, and brief descriptions of the detailed points of difference between all the following beasts of the group: Buffalo, Cape buffalo, gaur, bison, musk ox, gazelle, ariel gazelle, springbok, gemsbok, chamois, gnu, koodoo, eland, nylghau, deer, elk, reindeer, cariboo, wapiti, carcajou, musk deer, dromedary, Bactrian camel, and llama. We speak with diffidence of the work of a veteran like Mr. Wood, but we cannot but think that the practical teacher will be appalled at the idea of teaching so much detail as a portion only of a class-subject. The names we have cited are simply those of the animals dealt with in forty pages (including illustrations) of a fourth-standard reader of 275 pages; so that, of course, there are about five times as many beasts mentioned in the whole book. We do not think that many teachers will care to undertake to drum even all these unfamiliar names into the heads of Fourth Standard boys; still less will they care to try to add to all the rest of the knowledge which they are expected, in the brief space of some ten months, to pack into the poor little ten and eleven-year-old crania, the particulars of how a springbok differs from a gemsbok, or how they may know a koodoo from a carcajou. We would venture to suggest to Mr. Wood that in his next volume he should not thus enter into the details of species. It seems easy enough to him because he is so thoroughly familiar with his topic; and he naturally desires to make his work complete. But for children, such completeness is not necessary, but is, on the contrary, a stumblingblock in the way of their acquiring broad, general ideas. This, surely, is what it is designed by the framers of the Code that the elementary scholar should acquire—that he should learn the principles of the scheme of animated nature, but not that he should become an adept in universal natural history. What, in our judgment, then, should be done in a natural history reader is to state at length the distinguishing characteristics of a group of animals, and to give full and interesting facts about their habits and modes of life as a whole, but not to dwell on the immense variety of points of difference between the individuals composing the group.

We may now add that the books are so interestingly and easily written that we feel sure that children will readily read them through. Indeed, the volumes might be usefully added to all school libraries, or given as prizes. The illustrations are numerous, and, on the whole, excellent.

The earlier volumes having treated of the animals familiar to English children, Standard IV. goes through the less common mammalia, while Standard V. is devoted to birds, reptiles, and fishes. Invertebrates are left for Standard VI., which is still in preparation.

Animal Physiology. By Vincent T. Murché. London: Blackie and Son.

This is not a perfectly new book, but consists of the three parts, hitherto published separately, of 'Blackie's Physiology,' bound in one volume. We do not know if any slight alterations may have been made; but readers who have seen the three parts of the Physiology in

question may know that they have practically seen this volume.

Its special feature is that the plates have the names of the parts printed upon them, in red ink, instead of these being indicated by the customary method of reference-letters and text beneath the figure. This a good plan in some cases; in the figures of sections of the heart, for instance, it is effective. In other plates, however, the result is bad; the words are so printed as to completely mislead the young student. In the figure showing section of the nose, mouth, and pharynx (fig. 10) the legend 'Salivary glands' is loudly printed in red along the under surface of the tongue (on the genio-hyo-glossus muscle), while as a matter of fact not a gland is to be seen, the whole of these bodies having been dissected away before the drawing was made. The figure has been, of course, copied with very slight alterations from a large anatomical work; but the author of this little book has tried to independently increase the number of the references to the drawing with these fatal results. The anatomical students for whom the picture was originally drawn would, of course, have learned all about the genio-hyo-glossus muscle long before they reached the detailed study of the buccal cavity, and would know that this muscle had nothing to do with salivary glands. It is, perhaps, not wonderful that the head-master of Boundary Lane School should not recognise the muscle in question, but if Messrs. Blackie wanted to originate a new idea in the plates to Mr. Murché's book, they should have called in the supervision of a skilled anatomist, even if it were but a student of a hospital just through his 'first college.' We are not hypercritical in these remarks. The figure with its loud lettering will entirely mislead the pupil. It is in no way advisable to teach profound anatomy in our schools, but what we do teach should certainly be accurate, as far as it goes. Now, we do not know if Mr. Murché mistook the section through an incisor tooth for a salivary gland, but it is most likely that the young readers of his book will do so; and if they do not, they must suppose the muscles of the tongue to be salivary glands. These are the only alternatives that the picture offers a poor child; these are his Scylla and Charybdis on one of which he must make shipwreck.

Nor is this by any means a solitary instance of the mistake that the printing the names on the parts often turns out to be. In anatomical plates, the parts which are referred to are often a great deal smaller than their names. When the long name is printed above the small part, on the picture, instead of a line and a letter of reference to the explanatory text below the cut being used, the consequence is necessarily that the name spreads far beyond the part, and so the picture misleads the bewildered little learner, instead, of aiding his comprehension. Thus, we find the long name 'tendon of Achilles,' which appertains to a tendon only six inches in length, printed (fig. 8) so that it covers the entire muscle of the calf, right up to the knee joint. What conclusion can a child or a novice draw but that the gastrocnemius muscle is in fact the tendon of Achilles? In some of the woodcuts, again, the red printing, is far from legible; we may specially note figs. 6 and 14 in our copy as open to this objection. On the whole, then, we cannot advise other publishers to follow Messrs. Blackie's lead in this new departure; and the more so because we notice that, probably in consequence of the extra expense of the red printing, the number of engravings here is fewer than is usual in similar works; and children learn so readily through the eye that this is a point of some importance.

We have devoted so much attention to the woodcuts because they are the special and new feature of the work, and had they been really as serviceable as they at first sight appeared, would have placed the book in a high position amongst its class. We may speak briefly of Mr. Murché's letterpress.

This is fairly well done, from the literary point of view; the sentences are short, and the words plain and well-chosen. The effort to write lightly and graphically, not infrequently leads to the employment of phrases more picturesque than correct; such, for example, as this—'Some of the nerves pass into the organs of the body. . . . . There they act as masters, foremen, or gangers, and *see* that the work of each organ is properly carried on. *They give their orders and the organs merely do as they are told.*' It may be more amusing to a child to read such a statement than to receive a scientific explanation of how involuntary muscular action is controlled by the nervous system; but the object of teaching physiology is to give the benefits of scientific training to the mind, and not to amuse. The positive errors are not numerous, but still there are several of these. They occur, as might be expected, in the more abstruse sections of the subject. The statement about the accommodation of the eye must suffice for an example. 'The crystalline lens is, as you know, very elastic, and is held in its place by the suspensory ligaments. When we wish to look at an object a long way off, these ligaments are *drawn very tight by some muscles*, to which they are attached. If we next turn our attention to objects close at hand, the ligaments are *allowed to relax*, and the crystalline lens returns to its rounded or convex shape.' This is the exact reverse of the truth. The muscular action is connected with the looking at objects near at hand, the relaxation of the muscular action gives accommodation for far objects. The suspensory ligament of the lens, into which the elastic capsule of the lens passes, is attached to the ciliary muscle, through the intervention of the ciliary processes; the ciliary muscle, by its contraction, pulls forward the ciliary processes, and so takes the capsule of the lens off the stretch, and allows the anterior surface of the lens, by its own elasticity, to become more convex, and thus we view near objects. The cessation of the action of that muscle puts the capsule again on the stretch, and by merely leaving the only muscle concerned in a state of rest, flattens the lens, for viewing far distances. In fact, everybody may be conscious in his own person that 'the eye is rested'—that is to say, the muscle goes off duty—when the gaze is removed from near to far objects.

We need not correct other errors, similarly unimportant, perhaps, in practical bearing, but equally showing that the author has an imperfect acquaintance with his science. The broad facts of such a subject are easily enough read up, as the number of advanced science certificates issued from South Kensington is evidence of. But to write a thoroughly good elementary work, a very real knowledge of a subject is required. The author who knows a great deal more than he puts down is distinguishable in many ways from the one who reads up in order to write upon a subject, but especially in the strict accuracy of even the most sketchy passages that he pens.

On the whole, in the broad outline of the science, Mr. Murché is a trustworthy guide, and his book is sufficiently well-written to give it a fair chance of acceptance amongst elementary science teachers.

Handbook of Agriculture. By R. M. Ewing. With a Preface by Professor Scott. London: W. Swan Sonnenschein and Co.

Professor Scott, who is the editor of *The Farmer's Gazette*, and author of several agricultural books, declares in the Preface with which he has supplied this little volume, that he has never elsewhere met 'in the same small compass, with so compendious a summary of both the principles and practice of agriculture.' The praise is not undeserved or exaggerated. In the course of only some seventy pages of good-sized type, Mr. Ewing really accomplishes the almost incredible feat of giving a very fair outline of his entire subject. We do, indeed, regret that he has not taken more space. So admirably is his work executed, that it were to be wished he had made it somewhat fuller. It is now compressed to the last degree. Every sentence is as full of pith and as bare of words as it is possible to achieve. But this, though useful for that reading for examination which is

scornfully called 'cramming,' does not do an author full credit, or allow of his treating his subject with entire justice. We hope the success of this little work will be sufficient to lead Mr. Ewing to write a longer and more leisurely one at no distant date.

The subjects treated—and really treated, not only mentioned in passing—include soils, cropping, rotation of crops, haymaking, and ensilage; diseases of every kind of crops, insects, weeds, live stock, and the principles of feeding cattle, sheep, horses, pigs, and the description, breeding, and general management of poultry, live stock diseases, and dairy farming.

We confess that when we looked down the table of contents, it appeared simply impossible that so small a book could usefully deal with all the subjects set forth; and, accordingly, we commenced our examination of it with some amount of prejudice against it. But we soon found that Mr. Ewing had most extraordinary abilities for (to use an illustration racy of the soil) compressing intellectual fodder. Small though the bulk is, everything is there; squeezed together, and pressed up, but with the nutritiousness and the palatableness both unaffected. Our readers interested in agriculture as a "South Kensington subject," or in practical farming, should certainly procure this wonderful sixpennyworth.

Botany. By Vincent T. Murché. London: Blackie and Son.

The subject of botany suits Mr. Murché's brisk, terse style. There is a breezy feeling in these pages, which makes them quite bright reading. In fact, the English, though perfectly simple, rises sometimes to a really high level. We take it that Mr. Murché is personally interested in botany, and that this book was a labour of love. A work written in such a spirit is sure to be well done, with accuracy and vigour combined. This is a fair description of Mr. Murché's 'Botany,' which we are able to cordially recommend to teachers of this subject. It is illustrated with over one hundred and forty engravings, all up to Messrs. Blackie's usual high standard in this respect.

How to Manage Schools. A Guide to School Board Members and Managers of Schools. By H. Major, B.A., Inspector to the Leicester School Board. London: Grant and Co.

This book is not designed for teachers, but, nevertheless, they might draw some useful practical hints from its pages. Leicester teachers especially will be glad to know of the existence of the book, which will give them all their local inspector's ideas about school management. The great defect of the book is its tutorial tone. 'Members of School Boards and School Managers' are seldom so humble as it might become them to be, and most of them will feel rather insulted by Mr. Major's patronage. There is an amusing section at the end, where teachers will find the mirror held up to nature. Mr. Major thinks that it will be useful to managers to learn into what classes teachers, in his judgment, may be divided; and he accordingly presents them with a series of sketches, amidst which that of 'the good teacher' finds a place, but does not become very distinguishable, whilst no one can mistake the life-like accuracy of the pictures of 'the untidy,' 'the dogmatic' (the crowning fault of this one being that he 'ignores treatises on school management'), 'the faddy,' 'the whining,' and 'the martinet' teachers. To see ourselves as our inspectors see us is not quite an every-day luxury; but, perhaps, on the whole, we get as much of it as is absolutely necessary for our well-being, without looking for it in print.

Capital for Working Boys. By J. E. McConaughy. London: Hodder and Stoughton.

No teacher could desire a more suitable book as a present for a boy leaving school than 'Capital for Working Boys.' It aims at setting before boys a high ideal, and shows that the best capital they can start with in life, and continue to use through life, consists in the character which they may build up for themselves. There is a crispness in the composition, and an appositeness in the anecdotes and selected instances of successful individuals, chiefly from American sources, which make the book very pleasant reading, and cannot fail to produce a good impression on the youths who peruse it. No school library should be without it.

(*a*) **Oxford and Cambridge Local Examinations in Arithmetic,** from 1858 to 1883.
(*b*) **Answers to Oxford and Cambridge Local Examinations in Arithmetic.** By R. O. T. Thorpe, M.A. London: William Rice, Fleet Street.

The first-named volume is a clear and accurate reprint of all the Arithmetic Questions given to Senior and Junior Candidates since the commencement of these yearly examinations. Actual practice in the work already given is the surest method of testing a candidate's capabilities for passing, and teachers preparing pupils will find the book very useful. It may also be used with advantage by pupil-teachers, and candidates at the Scholarship and Certificate Examinations.

(*b*) The Answers by Mr. Thorpe are carefully printed and we have tested a sufficient number of examples to satisfy us of their accuracy in every respect.

(*a*) **Notes of Grammar Lessons.**
(*b*) **Grammar Exercises.** Parts I., II., III. National Society's Depository, Westminster.

This work contains Notes of Lessons for every part of grammar which enters into the course of study in elementary schools. The method and matter, with the exception of the exercises, are alike admirable, the compiler evidently being a practical teacher of ability. Pupil-teachers, and assistants who have not had the advantage of a pupil-teacher's training, will do well to obtain the book.

We cannot speak so favourably of the Grammar Exercises, which are reprinted from the Notes. They are not carefully graduated, are too long for single lessons, and are entirely wanting in poetical extracts, which present more difficulties than prose, and are now so commonly given. The compiler, we think, has altogether underestimated the time at the disposal of teachers for working the exercises and the quarterly examination papers which are appended.

The Musician: a Guide for Pianoforte Students. By Ridley Prentice. Grade III. London: W. Swan Sonnenschein and Co., Paternoster Row.

We have before had occasion to review most favourably Grades I. and II. of this series, and we observe with pleasure that the book now before us is in every respect fully equal to its predecessors. This grade is specially suitable for pianoforte students who are able to play pieces of moderate difficulty; and a complete list of such pieces, all by classical composers, arranged in progressive order of difficulty, and including those analysed, is given at the beginning of the book.

A brief recapitulation of the substance of the First and Second Grades forms an introduction which enables the pupil, if necessary, to dispense with these grades, and begin at once with the more difficult pieces suited to his capacity.

Every page of this little work is full of interest, and the sympathetic and appreciative sketches of the great masters and their works, which are scattered throughout the volume, cannot fail to instruct and stimulate.

Song-Book for Schools. A Graduated Collection of Songs adapted for the use of Children. By C. Villiers Stanford, Mus. Doc., Organist of Trinity College, Cambridge. London: National Society's Depository.

In this song-book Dr. Stanford has arranged and harmonized a large number of our best old English melodies. It is almost unnecessary to say that the work has been done with much taste, skill, and judgment. A few of the melodies are, we admit, rather difficult, and, to modern ears, somewhat vague in tonality, but their presence is necessary to complete the design, and they do not detract from the value of the collection, which we cordially recommend to all our readers.

A Digest of English History, from 1689 to 1760. By M. Gutteridge, B.A. London: Relfe Brothers.

Mr. Gutteridge claims for this digest of the history of an important epoch in English history that 'it is reliable, tangible, and chronological. In these days of examination the surface to be covered is so wide and the depth to be dug so great, both for pupils and teachers, that he who lightens the labour of the one without injury to the other should be deemed a welcome co-worker.' Mr. Gutteridge has fully maintained his claim. His book is thoroughly practical, its arrangement is clear, and its information precise, suitable, and accurate. When used as a supplement to a full history, it will be very useful for revision and preparation for examination. While well adapted for all junior students, the book is meant more especially for use by University Local Examination candidates.

*** *Several Reviews are unadvoidably held over.*

Publications Received.

Blackie and Son—

Animal Physiology. By Vincent T. Murché.
Botany. By Vincent T. Murché.
The Principles of Agriculture.

Chambers (W. and R.)—

Chambers' Graduated Reader. Book V.
Elements of Euclid. By J. C. Mackay, M.A.

Heywood (John)—

English History in Rhyme.
Gardiner's Explanatory Geography. Part I. For standards I. and II.

Longmans and Co.—

The Art of Solving Problems in Higher Arithmetic. By Rev. J. Hunter, M.A.
Longman's Magazine. August.
Longman's Modern Copy Books. By J. Tidmarsh.
Text-Book on Practical Solid or Descriptive Geometry. Part II. By D. A. Low.

National Society's Depository—

Song-Book for Schools. Parts I. to VII., and Complete. By C. Villiers Stanford.
Grammar Exercises. Parts I. to III.

Nelson (T.) and Sons—

The New Royal Reader, No. 6.
The New Royal Reader Home Lesson Books, Nos. 1 to 5.

Simpkin, Marshall and Co.—

Picturesque Wales. By Godfrey Turner.
A Practical Guide to German Conversation. Parts I. and II. By Karl Geugnagel, Ph.D.

Smith, Elder and Co.—

Cornhill Magazine. August.

Willcocks (W. J.) and Co.—

The Magazine of Music. Part V.

MURBY'S SCHOOL SERIES.

MURBY'S HISTORICAL READING BOOKS.

Graphically written and fully Illustrated.

SIXTY SHORT STORIES FROM ENGLISH HISTORY. In accordance with the recent Circular of the Department to H.M.'s Inspectors. 160 pp., extra fcap. 8vo, 10d. cloth boards, cloth limp 7d.

A SIMPLE SKETCH OF THE HISTORY OF ENGLAND, from the time of the Britons to the Crimean War. In Sixty Lessons. 192 pp., extra fcap. 8vo, 1s. cloth boards, 8d. cloth limp. Pronounced by one of H.M. Inspectors the best Series that he has yet seen.

EXCELSIOR READER, No. I., enlarged to 128 pages, price 6d.; Cheap Edition, 4d.

EXCELSIOR READER, No. II., enlarged to 128 pages, price 7d.; Cheap Edition, 5d.
These additions comprise selected Poetry for Recitation—easy, pleasing, and acceptable in every sense.

THE IMPERIAL READING BOOKS.

An entirely New and Superior Series, embracing many new features of practical importance.

IMPERIAL PRIMER. Very large type, 32 pp.; 26 Illustrations, cloth, 3d.

FIRST IMPERIAL READER. 96 pp., extra cloth boards, 8d.; cheap edition, 6d.

SECOND IMPERIAL READER. Post 8vo, 128 pp., extra cloth boards, 9d.

THIRD IMPERIAL READER. Post 8vo, 192 pp., extra cloth boards, 1s.

FOURTH IMPERIAL READER. Post 8vo, 256 pp., extra cloth boards, 1s. 4d.

GRAMMAR TESTS, for Standards III., IV., V., and VI. 9d. per packet. A most useful help for teaching as well as testing.

DODD'S ARITHMETICAL TEST CARDS, with the above Grammar Tests on back, 1s. per packet.

LANGTON'S ARITHMETICAL EXAMPLES, altered to suit the current Code. Highly recommended. Standards I. to VII., 1½d. each. Answers, 3d. each.

ALGEBRA FOR BEGINNERS. Stages I. and II., altered to suit the present Code. 32 pages, price 3d. each. Stage III., price 6d. Replete with well-graded Examples.

MURBY'S NEW SCHOOL WALL MAPS. Photo-Lithographed from Reliefs. Several Prize Medals. Adopted by the London School Board. These Maps are issued in two forms—(a) Physical; (b) Physico-Political, except the World and Australia, which are Physical only.

	Price.	To Schools.
EUROPE, 60 in. by 51 in.	21s. 0d.	16s. 0d.
CENTRAL EUROPE, 60 in. by 57 in.	21s. 0d.	16s. 0d.
ASIA, 60 in. by 57 in.	21s. 0d.	16s. 0d.
AFRICA, 52 in. by 44 in.	16s. 0d.	12s. 0d.
PALESTINE, 54 in. by 30 in.	16s. 0d.	12s. 0d.
THE WORLD, 81 in. by 50 in.	30s. 0d.	22s. 6d.
THE HEMISPHERES, 42 in. by 50 in.	16s. 0d.	12s. 0d.
NORTH AMERICA, 44 in. by 40 in.	16s. 0d.	12s. 0d.
SOUTH AMERICA, 42 in. by 30 in.	12s. 0d.	9s. 0d.
BRITISH ISLANDS, 50 in. by 55 in.	21s. 0d.	16s. 0d.
AUSTRALIA AND NEW ZEALAND, 62 in. by 45 in.	21s. 0d.	16s. 0d.

* *Several Sets of this Series, slightly soiled, may be had at greatly reduced prices.*

MURBY'S NATURAL HISTORY WALL SHEETS.

Adopted by the London and principal Provincial School Boards. Extremely useful for Object Lessons. Splendid wall decorations (an item in assessing the Merit Grant), beautifully coloured, neatly mounted on stout cardboard ready for hanging. The set, comprising 20 cards, complete with Manual of Natural History, 42s.

SHEET	SHEET
1.—Human Physiology.	13.—Plants.—Umbelliferous Tribe, etc.
2.—Human Physiology.	14.—Plants.—Olive, Rose, Vine, etc.
3.—Vertebrates.—Mammals.	15.—Plants.—Nettle, Mallow, Flax, etc.
4.—Vertebrates.—Birds.	16.—Plants.—Coniferous Tribe, etc.
5.—Vertebrates.—Reptiles, Fish.	17.—Plants.—Grass and Lily Tribes.
6.—Articulates.—Insects.	18.—Plants.—Moss, Lichen, etc.
7.—Articulates.—Crustacea, etc.	19.—Geology.—Fossils, etc.
8.—Woods, Natural Specimens of.	20.—Minerals, Natural Specimens of.
9.—Plants.—Leaves, Flowers.	
10.—Plants.—Fruits and Seeds.	
11.—Plants.—Composite Tribe.	
12.—Plants.—Leguminous Tribe.	

The usual discount of 25 per cent. given to Schools.

THOMAS MURBY, 3, Ludgate Circus Buildings, London, E.C.

BRITISH MUSEUM 27 AU 84

PREVENTION AND CURE OF CHOLERA.

THIS terribly fatal malady is now within measurable distance of our own shores. It therefore behoves us not only to look well to all our sanitary arrangements, but also to protect ourselves as far as possible from any personal attack.

In localities where Cholera has been raging, it has been noticed from time to time, by many eminent medical men and others, that Oxygen, in its allotropic form, 'Ozone,' has been absent from the atmosphere. In 1854 Dr. Boekal, of Strasburg, made regular ozonometric observations in that city, and was thereby led to suppose that a connection exists between the presence of Cholera and the diminution of the quantity of ozone in the atmosphere.

The inhalation of oxygen may be very good as a remedial agent in the collapse stage, but we have to consider the best means of keeping the body well supplied with the necessary magnetic power to enable the arterial blood to take a sufficient quantity of oxygen from the atmospheric air, and carry it through the blood-vessels to every part of the body. By wearing Darlow's Magnetine appliances, which supply the requisite amount of the electric force, without the aid of acid or fluid of any knid, the body can be fortified against Choleraic attacks. The appliances require no cleaning, nor, indeed, any care or attention whatever. They are put on with the garments when dressing in the morning, and generally laid aside on retiring to rest at night. They give no *shocks*, and cause no *sores*. Their action on the system is gentle and imperceptible, but then it is *continuous*: it may go on unceasingly every moment, night and day, and yet this is entirely at the option of the wearer, who may lay the appliances aside when he pleases. As a rule they are not worn during the night. But they are always ready, always effective, and gradually produce a most beneficial change in the condition of the entire frame. For the most part they are unfelt in their operation—they cannot harm an infant—and the most delicate invalid may be under their influence without having the consciousness of any unpleasant or even unusual sensation, except it be, indeed, the delightful glow of returning health and strength.

The direct action of Magnetism is on the iron in the blood.

Darlow's Magnetine Belts for Ladies, 27s. | Darlow's Magnetine Belts for Gentlemen, 25s.

Descriptive Pamphlet Post Free.

DARLOW & CO., 443. STRAND, LONDON.

☞ USE DR. GENGNAGEL'S New System, which 'is, no doubt, the *only one* to secure *fluent conversation*. A *rational* method, ... creating a good colloquial style.'—*Schoolmaster*. 'We gladly recommend it to those who wish to learn or teach the language colloquially.'—*Ed. Times*.

A Practical Guide to German Conversation, 3s.

A Practical Introduction to French Conversation, 2s.

London: SIMPKIN, MARSHALL & CO.

CIVIL SERVICE.—Female Clerks, Men and Boy Clerks, Excise, Customs, etc. Candidates rapidly prepared through post on a thoroughly individual system. Fifty successes during 1883. Prospectus, containing list of successes, testimonials, etc., free on application to J. Keefe, F.R.G.S., etc., Civil Service Academy, Liverpool.

Tuition by Correspondence.

CERTIFICATE.—The preparation established in 1871 is available as usual. The following are the fees charged for correspondence twice a week :— Per quarter. By results.

Masters: First Year.....	15s.	...	£2
,, Second Year	21s.	...	£5
Mistresses: First Year	10s.	...	£1
,, Second Year.....	15s.	...	£3

Pupils who prefer the quarterly arrangement remit the fee at the end of the quarter. Those who select 'Payment by Results' are not required to part with any money for Tuition until a pass is recorded; and, if the pupil is unsuccessful after two attempts, the agreement will be cancelled without payment.

MATRICULATION (Established 1871), Science, Drawing, Scholarship, A.C.P., Civil Service, Diocesan, Shorthand, Musical, Medical, Legal, P.T. Papers, and other branches as advertised. *No payment unless successful.*

Address, Mr. JAMES JENNINGS, Tuition by Correspondence Office, Deptford, London.

SCHOOL DESKS.

GEORGE E. HAWES,

ONLY

SCHOOL DESK MANUFACTURER

IN

EASTERN COUNTIES,

Has now on view at the Health Exhibition, Stand 1389, Albert Hall, patterns of all the celebrated

EAST ANGLIAN

AND

NORWICH DESKS.

SINGLE, DUAL, & CONVERTIBLE.

Infant Galleries with Desk and Seats combined.
Pupil Teacher's Desk with Seat attached.

For Particulars apply G. E. HAWES,

STEAM JOINERY WORKS,

DUKE'S PALACE,

NORWICH.

APPROVED EDUCATIONAL WORKS.

By J. C. CURTIS, B.A.

A School and College History of England, containing copious supplementary Chapters on Religion, Constitutional History, Literature, Commerce, etc. 26th Thousand. Price 5s. 6d.
'A most admirable general narrative is given of political events.'—*Civil Service Gazette.*

A Short Manual of English History. With Genealogical Tables. 13th Thousand. Price 6d.
'One of the best summaries of English History which has yet been published.'—*Educational Times.*

Outlines of English History. 254th Thousand. Price 6d.
'As an introduction to English History we know of none equal to it.'—*Quarterly Journal of Education.*

Outlines of Scripture History. 42nd Thousand. Price 6d.
'Concise, comprehensive, and well-arranged.'—*Church and School Gazette.*

An English Grammar for Schools. With numerous Exercises, Examples of Parsing, Analysis, etc. 21st Thousand. Price 1s.
'The definitions are plain and exact, and the explanatory notes are most clear and forcible.'—*Schoolmaster.*

Outlines of English Grammar. With copious Exercises. 224th Thousand. Price 6d.
'Remarkably clear in its definitions, copious in its facts, and rich in the examples it gives for exercise.'—*Freeman.*

A Manual of Grammatical Analysis. With copious Exercises for Analysis and Composition. 77th Thousand. Price 6d.
'A very clear and excellent manual.'—*School Board Chronicle.*

A Manual of Etymology. 18th Thousand. Price 6d.
'Ably executed. The notes are especially valuable.'—*Educational Review.*

Outlines of Geography. 176th Thousand. Price 6d.
'A most excellent manual.'—*Court Circular.*

The Geography of Great Britain and Ireland. 13th Thousand. Price 6d.
'An excellent little treatise, which we can cordially recommend; it is full, accurate, and concise.'—*Educational Reporter.*

The Poetical Reader. 122nd Thousand. Price 1s.
'Just such a selection of spirited, genuine, and accredited ballads and pieces as we should wish our children to have at their tongues' end.'—*Patriot.*

The New Poetical Reader. 25th Thousand. Price 1s.
'We congratulate Mr. Curtis on having made so good a selection. It is sure to be a favourite wherever introduced.'—*National Schoolmaster.*

LONDON: SIMPKIN, MARSHALL, & CO.,
And all Booksellers in Town and Country.

ESTABLISHED 1851.

BIRKBECK BANK.—Southampton Buildings, Chancery Lane.

Current Accounts opened according to the usual practice of other Bankers, and Interest allowed on the minimum monthly balances when not drawn below £50. No commission charged for keeping Accounts.

The Bank also receives money on deposit at Three per cent. Interest.

The Bank undertakes for its customers, free of charge, the custody of Deeds, Writings, and other Securities and Valuables; the collection of Bills of Exchange, Dividends, and Coupons; and the purchase and sale of Stocks and Shares. Letters of Credit and Circular Notes issued.

A Pamphlet, with full particulars, on application.

March, 1880. FRANCIS RAVENSCROFT, Manager.

The Birkbeck Building Society's Annual Receipts exceed Four Millions.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH, with immediate Possession and no Rent to Pay. Apply at the Office of the BIRKBECK BUILDING SOCIETY.

HOW TO PURCHASE A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession, either for Building or Gardening purposes. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY.

A Pamphlet, with full particulars, on application.

FRANCIS RAVENSCROFT, Manage

Southampton Buildings, Chancery Lane.

HELPS FOR BUSY TEACHERS IN DAY AND SUNDAY SCHOOLS.

THE SYSTEMATIC BIBLE TEACHER and BIBLE VOICES FOR THE YOUNG, post free, 2s. 6d.,

Contains a *complete system* used by Dr. Watts in the training of *Sir Thomas Abney*. No one who teaches these simple lessons can fail to reach and help fathers at home, and secure the Divine blessing.

The PRACTICAL TEACHER, of July 1, says of

THE GOSPEL MANUAL. GRADE III., 1s. 6d.,—

'This book is arranged by one whose acquaintance with Gospel History is as wide as his knowledge of Sunday School requirements. Each page is divided into three columns, the middle one containing the Lesson compiled from the Four Gospels; the first column the Geographical Questions, Parallels, etc.; and the third column, a Series of Explanatory Notes and Illustrative Remarks, etc.'

SCHOOL AND HOME, a Monthly Penny Illustrated Magazine; also in Vols. at 1s. 6d. each.

Reports of the Mission on application to the *Manager*,

SYSTEMATIC BIBLE TEACHING MISSION,

67, PATERNOSTER ROW, E.C.

EYRE & SPOTTISWOODE'S

MATHEMATICAL DRAWING INSTRUMENTS,

WATER-COLOURS, OIL-COLOURS,

And all Drawing Materials suitable for Technical and Art Students:

BEST TOWN-MADE DRAWING INSTRUMENTS,

As used in Public Schools.

EYRE & SPOTTISWOODE,

London—Great New Street, Fleet Street, E.C.

SCHOLASTIC MUSICAL INSTRUMENT CO.

(ESTABLISHED 1871).

To supply Teachers, School Board Members, and School Managers with ANY kind of Musical Instrument from ANY Maker at bona fide Trade Price for Cash, or by Easy Instalments.

Every one should read our Circular and Extracts, which are sent Post free.

Apply to the MANAGER, 39 Osney Crescent, Camden Road, N.W.

'We have now had plenty of time to try the piano; and I can say to you how very much we are pleased with it, and how greatly I am obliged to you for procuring me so excellent an instrument so cheap.'—MATTHEW ARNOLD, Esq., H.M.I.

'You are at liberty to make any use of my wife's and my own opinion—that the piano is excellent both for tone and touch, and that it is a very cheap piano.'—Rev. T. W. SHARPE, M.A., *H.M.I. for Training College for Schoolmasters.*

15,000 similar Testimonials have been received from all parts of the country, from H.M. Inspectors, Assistant Inspectors, Presidents of N.U.E.T., Principals and Masters of Training Colleges, Teachers and School Board Clerks.

THE ONLY ADDRESS IS

39, OSENEY CRESCENT, CAMDEN ROAD, LONDON, N.W.

MURBY'S IMPERIAL COPY BOOKS.

'EXCELLENT.' 'UNEXCELLED.'

These superior Copy Books are rapidly finding their way into all good schools.

The following new numbers have lately been added:—

No. 3½, Text and Large Text.

No. 5½, Large Hand and Small.

No. 12½, Girls' Finishing Hand.

Making in all seventeen numbers. Price 2d. each

*** *Specimens on application.*

TRADE MARK.

I have worn this Corset three days, and every bone over the Hips is broken.

I have worn the 'Flexible Hip Corset' three months, and every bone is still perfect.

DR. WARNER'S PATENT

FLEXIBLE HIP CORSET

Being constructed after the analogy of the Human Form, is warranted not to break over the Hips. The bones in it passing like the Ribs around the Body secure a perfect fitting Corset, so comfortable that a lady can lie down with ease, so flexible that it yields readily to every movement, and yet so firm that it gives great support at the sides.

Black Stitched Gold, 4/5; superior quality, 8/5; White or Drab, 5/5, post free. Post Office Orders payable to

B. AMERY, CLAPHAM RISE, LONDON, S.W.

MY AUTUMN DRESSES from 5/9=12 yards.

MY VELVETEENS 1/6½ Yard.

Patterns Free.

B. AMERY, 5 & 7, High St., Clapham, London.

W. SWAN SONNENSCHEIN & Co.'s PRIZE BOOKS.

Dr. WAGNER'S Great Work on Norse and English Antiquities and Mediæval Fiction.

ASGARD and the GODS: a Manual of Norse Mythology. Third Edition, Illustrated, 6s.

EPICS and ROMANCES of the MIDDLE AGES. Second Edition, Illustrated, 7s. 6d.

Each work in one volume, 8vo, old-fashioned paper boards, vellum back.

LETTERS of the MARTYRS of the ENGLISH CHURCH. Reprinted from the Edition of MILES COVERDALE. Crown 8vo, 3s. 6d.

By Rev. HENRY WOOD. Fully Illustrated, Crown 8vo, 3s. 6d.

A SEASON AMONG the WILD FLOWERS.

'No more useful companion could the young botanist take with him in his country-side rambles.'—*Literary World.*

By Rev. HILDERIC FRIEND.

FLOWERS and FLOWER LORE. Fully Illustrated. Second Edition. 7s. 6d.

3s. 6d. Series. Fully Illustrated. Crown 8vo, extra cloth, gilt edges.

THREE GREAT LIVES: Sir Thos. More, Latimer, SAVONAROLA. By FRANCES E. COOKE.

NOTABLE WOMEN of the REFORMATION. By WILLIAM CHAPMAN.

NOTABLE WOMEN of PURITAN TIMES. By WILLIAM CHAPMAN.

The HEROES of AFRICAN DISCOVERY and ADVENTURE.

SERIES I.—TO DEATH OF LIVINGSTONE. Second Edition.
SERIES II.—TO END OF 1882. Second Edition. By C. E. BOURNE.

By the SAME AUTHOR.

STORIES of the LIVES of the GREAT COMPOSERS.

GREAT DUTCH ADMIRALS. By JACOB DE LIEFDE.

OUR GREAT NAVAL COMMANDERS. By Prof. C. DUKE YONGE.

BRAVE BOYS who have become Illustrious Men of our Time. Fourth Edition. By J. M. DARTON.

By the SAME AUTHOR.

FAMOUS GIRLS who have become Illustrious Women of our Time. Nineteenth Edition.

AUSTRALIA and its INHABITANTS. By Dr. K. JUNG.

LIFE at HOME, at SCHOOL, and at COLLEGE. By an Old Etonian.

2s. 6d. Series. Fully Illustrated. Crown 8vo, extra cloth, gilt edges.

MADGE HILTON; or, Left to Themselves. By AGNES MAITLAND.

MOONFOLK: A True Account of the Home of the Fairies.

OLD NORSE SAGAS. By EMILY S. CAPPEL.

OLD NORSE FAIRY TALES. By GEORGE STEPHENS and H. CAVALLIUS.

OUR GREAT MILITARY COMMANDERS. By ROSCOE MONGAN, B.A.

STEPHENSON, GEORGE and ROBERT: Their Lives and Deeds. By F. L. CLARKE.

1s. 6d. Series. Fully Illustrated. Crown 8vo, extra cloth, gilt edges.

BIRDS and their WAYS. By J. ARMSTRONG.

CHARLEMAGNE and his TIME. By F. L. CLARKE.

CHILDHOOD of the PRINCE CONSORT. Second Edition. By F. L. CLARKE.

LIFE of CHARLES XII. By A. ALBERG.

LIFE of MARTIN LUTHER. By W. CHAPMAN.

LIFE of JOHN WICLIF. By W. CHAPMAN.

LIFE of SIR WALTER RALEIGH. By F. L. CLARKE.

LIFE of GEORGE STEPHENSON. By F. L. CLARKE.

LIFE of ROBERT STEPHENSON. By F. L. CLARKE.

LIFE of RACHEL, LADY RUSSELL. By M. GUIZOT.

LIFE of GUSTAVUS ADOLPHUS. By C. E. BOURNE.

ONLY A DROP OF WATER. Second Edition. By E. STAFFORD.

TALES from the EDDA. By HELEN ZIMMERN.

LONDON: W. SWAN SONNENSCHEIN AND CO., PATERNOSTER SQUARE.

HARMONIUMS, AMERICAN ORGANS, PIANOFORTES.

J. COOPER & CO.,

SCHOLASTIC MUSICAL INSTRUMENT MANUFACTURERS,
70, Shepperton Road, New North Road, Islington, London N.
Works: Peabody Yard, Essex Road.

SOLE MAKERS OF

THE 'CHORISTER' ORGAN

(REGISTERED).

The Cheapest and Best Organ in the World.

☞ 'I never heard anything like it before at the price.'

'"The Chorister" deserves to be widely known.'

'It is a splendid organ in every way.'

'Admirably sweet in tone, and highly finished in appearance.'

SEE TESTIMONIALS.

The greatest possible advantages are given to Managers and Teachers. Descriptive List post free.

Small crown 8vo, 368 pages, 3s. 6d.

THE

Historical School Geography.

By Dr. MORRISON, M.A., F.R.G.S.

NEW EDITION REVISED.

Specimens sent for 1s. 9d. in stamps by the author, 39, Fountayne Road, Stoke Newington, London.

'Altogether Dr. Morrison's book is a decided advance beyond the dry compendium of names and mere skeleton statements which characterize many geographical text-books. It is high time that many of these gave way for such thoughtful and well-written manuals.'

—*Practical Teacher.*

Also by the same Author,

THE SHILLING GEOGRAPHY.

Specimens sent free for 8 stamps.

LONDON: SIMPKIN, MARSHALL AND CO.

THE LAST AND BEST TEST CARDS ISSUED.

AKRILL'S ARITHMETICAL AND SPELLING CARDS FOR THE 1884 CODE.

Specially prepared by James Tipton, First Class Certificated Master.

Price 1s. per set, subject to usual School Discount.

Whilst the greatest pains have been taken to make these Cards the *best* in the market as ARITHMETICAL TEST CARDS, their *special feature* is the SPELLING—**nothing like them, for completeness, have appeared before.**

The Seven Sets contain on the back OVER SIX THOUSAND DIFFERENT WORDS, embracing every word in ordinary use in the English language; ALL THE LATIN PREFIXES, with copious illustrations; 312 of the LATIN ROOTS (Verbs), from which our principal words are derived.

London: SIMPKIN, MARSHALL & CO., Stationers' Hall Court.
Lincoln: CHARLES AKRILL, 253, High Street.

G. BELL & SONS' EDUCATIONAL BOOKS.

Complete Catalogue of upwards of 500 Educational Books of all kinds, sent post free on application.

BIBLIOTHECA CLASSICA.

A Series of Greek and Latin Authors, with English Notes; edited by eminent Scholars, under the direction of the late GEORGE LONG, M.A., Fellow of Trinity College, Cambridge; and the late Rev. A. J. MACLEANE, M.A., Head Master of King Edward's School, Bath. Demy 8vo.

ÆSCHYLUS. By F. A. PALEY, M.A. Fourth Edition, revised. 18s.

CICERO'S ORATIONS. By G. LONG, M.A. £3 4s. Vol. I., 16s.; Vol. II., 14s.; Vol. III., 16s.; Vol. IV., 18s.

DEMOSTHENES. Vols. I. and II. By R. WHISTON, late Head Master of Rochester Grammar School. 16s. each.

EURIPIDES. By F. A. PALEY, M.A. 3 Vols., Second Edition. 16s. each.

HERODOTUS. By Rev. J. W. BLAKESLEY, B.D. Two Vols., 32s.

HESIOD. By F. A. PALEY, M.A. 10s. 6d.

HOMER. Vol. I., ILIAD, I.—XII., with Introduction by F. A. PALEY, M.A., 12s. Vol. II., 14s.

HORACE. By Rev. A. J. MACLEANE, M.A. Fourth Edition, Revised by GEORGE LONG. 18s.

JUVENAL and PERSIUS. By Rev. A. J. MACLEANE, M.A., Trinity College, Cambridge. Second Edition, Revised by GEORGE LONG, 12s.

LUCAN. THE PHARSALIA. By C. E. HASKINS, M.A. Fellow of St. John's College, Cambridge. *[Preparing.*

PLATO. By W. H. THOMPSON, D.D., Master of Trinity College, Cambridge. Vol. I. Phædrus, 7s. 6d. Vol. II., Gorgias, 7s. 6d.

SOPHOCLES. Vol. I. 18s. By Rev. F. H. BLAYDES, M.A. Contents: Œdipus Tyrannus, Œdipus Coloneus, Antigone.

SOPHOCLES. Vol. II., 12s. By F. A. PALEY, M.A. Contents: Philoctetes, Electra, Trachiniæ, Ajax.

TACITUS. The ANNALS. By the Rev. P. FROST. 15s.

TERENCE. By E. ST. J. PARRY, M.A. 18s.

VERGIL. By the late Prof. CONINGTON, M.A.

Vol. I.—The BUCOLICS and GEORGICS. Fourth Edition, Revised by Prof. NETTLESHIP, Corpus Professor of Latin at Oxford. With New Memoir, and Three Essays on Vergil's Commentators, Text, and Critics. 14s.

Vol. II.—The ÆNEID, Books I. to VI. Fourth Edition, 14s. *[Just Published.*

Vol. III.—The ÆNEID, Books VII. to XII. Third Edition, Revised by Prof. NETTLESHIP. 14s.

Uniform with the above.

A COMPLETE LATIN GRAMMAR. By J. W. DONALDSON, D.D. Third Edition, 14s.
[London: WHITTAKER & Co.]

CAMBRIDGE GREEK AND LATIN TEXTS.

Being for the most part the Texts of the *Bibliotheca Classica* and the *Grammar-School Classics*. 16mo, bound uniformly in neat cloth, with red edges.

ÆSCHYLUS. By F. A. PALEY, M.A. 3s.

CÆSAR de BELLO GALLICO. By G. LONG, M.A. 2s.

CICERO de SENECTUTE et de AMICITIA, et EPISTOLÆ SELECTÆ. By G. LONG, M.A. 1s. 6d.

CICERONIS ORATIONES. Vol. I. (In Verrem.) By G. LONG, M.A. 3s. 6d.

EURIPIDES. By F. A. PALEY, M.A. 3 Vols., each 3s. 6d.

HERODOTUS. By J. G. BLAKESLEY, B.T.B. 2 Vols., each 3s. 6d.

HOMERI ILIAS. I.—XII. By F. A. PALEY, M.A. 1s. 6d.

HORATIUS. By A. J. MACLEANE, M.A. 2s. 6d.

JUVENAL et PERSIUS. By A. J. MACLEANE, M.A. 1s. 6d.

LUCRETIUS. By H. A. J. MUNRO, M.A. 2s. 6d.

SALLUSTI CRISPI CATILINA et JUGURTHA. By G. LONG, M.A. 1s. 6d.

SOPHOCLES. By F. A. PALEY, M.A. 3s. 6d.

TERENTI COMŒDIÆ. By W. WAGNER. 3s.

THUCYDIDES. By J. G. DONALDSON, D.D. 2 Vols., each 3s. 6d.

VERGILIUS. By Prof. CONINGTON, M.A. 3s. 6d.

XENOPHONTIS EXPEDITIO CYRI. By J. F. MACMICHAEL, B.A. 2s. 6d.
[London: WHITTAKER & Co.]

GRAMMAR SCHOOL CLASSICS.

CÆSAR de BELLO GALLICO. By G. LONG, M.A. 5s. 6d.
Books IV., V., separately, 1s. 6d. Books I.—III., for Junior Classes, 2s. 6d.

CATULLUS, TIBULLUS, and PROPERTIUS. Selected Poems. By the Rev. A. H. WRATISLAW and F. N. SUTTON, B.A. 3s. 6d.

CICERO.—De SENECTUTE, De AMICITIA, and SELECT EPISTLES. By G. LONG, M.A. New Edition. 4s. 6d.

CORNELIUS NEPOS. Edited by the late Rev. J. F. MACMICHAEL, Head-Master of the Grammar School, Ripon. 2s. 6d.

HOMER.—ILIAD. Books I.—XII. Edited by F. A. PALEY, M.A. 6s. 6d.

HORACE.—By A. J. MACLEANE, M.A. 6s. 6d.; or, in 2 Parts, 3s. 6d. each.

JUVENAL.—SIXTEEN SATIRES (expurgated). By H. PRIOR, M.A., late Scholar of Trinity College, Oxford. 4s. 6d.

MARTIAL.—SELECT EPIGRAMS. By F. A. PALEY, M.A., and W. H. STONE. 6s. 6d.

OVID.—The FASTI. By F. A. PALEY, M.A. 5s.

SALLUST.—CATILINA and JUGURTHA. New and Revised Edition. By J. G. FRAZER, M.A., Fellow of Trinity College, Cambridge. *[Preparing.*

TACITUS.—GERMANIA and AGRICOLA. By Rev. P. FROST. 3s. 6d.

VIRGIL. (Abridged from Prof. CONINGTON'S Edition.) Vol. I.—Bucolics, Georgics, and Æneid. Books I.—IV., 5s. 6d. Æneid, Books V.—XII., 5s. 6d. Also in 9 parts, 1s. 6d. each.

XENOPHON'S ANABASIS. By the late J. F. MACMICHAEL. 5s. Also in 4 Parts, 1s. 6d. each.

—— CYROPÆDIA. By G. M. GORHAM, M.A., late Fellow of Trinity College, Cambridge. 6s.

—— MEMORABILIA. By Rev. P. FROST, M.A. 4s. 6d.
[London: WHITTAKER AND Co.]

PUBLIC SCHOOL SERIES.

A Series of Classical Texts. Annotated by well-known Scholars with a special view to the requirements of Upper Forms in Public Schools or of University Students. In Crown 8vo.

ARISTOPHANES' PAX. By F. A. PALEY, M.A. 4s. 6d.

—— ACHARNIANS. By F. A. PALEY, M.A. 4s. 6d.

—— FROGS. By F. A. PALEY, M.A. 4s. 6d.

CICERO'S LETTERS to ATTICUS. Book I. By A. PRETOR, M.A. New Edition, revised, 4s. 6d.

DEMOSTHENES' ORATION against the LAW of LEPTINES. By B. W. BEATSON, M.A. 3s. 6d.

—— DE FALSA LEGATIONE. By the late R. SHILLETO, M.A. Fifth Edition. 6s.

PLATO'S APOLOGY of SOCRATES and CRITO. By W. WAGNER, Ph.D. 7th Edition. 4s. 6d.

—— PHÆDO. Seventh Edition. By W. WAGNER, Ph.D. 5s. 6d.

—— PROTAGORAS. By W. WAYTE, M.A. Fourth Edition, Revised, 4s. 6d.

—— EUTHYPHRO. By G. H. WELLS, M.A. Second Edition. 4s.

—— EUTHYDEMUS. By G. H. WELLS, M.A. 4s.

—— REPUBLIC. Books I. and II. By G. H. WELLS, M.A. 5s. 6d.

PLAUTUS' TRINUMMUS. By WILHELM WAGNER, Ph.D. Second Edition. 4s. 6d.

—— AULULARIA. By W. WAGNER, Ph.D. Second Edition, re-written. 4s. 6d.

—— MENÆCHMEI. W. WAGNER, Ph.D. 4s. 6d.

—— MOSTELLARIA. By Prof. E. A. SONNENSCHEIN, M.A. *[Preparing.*

SOPHOCLIS TRACHINIÆ. By A. PRETOR, M.A. 4s. 6d.

TERENCE. By W. WAGNER, Ph.D. 10s. 6d.

THEOCRITUS. With Latin Notes. By F. A. PALEY, M.A. Second Edition. 4s. 6d.

THUCYDIDES, Book VI. By T. W. DOUGAN, M.A., Fellow of St. John's College, Cambridge; Professor of Latin in Queen's College, Belfast. 6s. *[Just published.*

Cambridge Texts, with Notes.

Select portions of the Greek and Latin Authors, with Introduction and Notes by eminent Scholars, for Young Students. The Texts are those of the *Bibliotheca Classica* and the *Grammar-School Classics*. In fcap. 8vo, 1s. 6d. each, with exceptions.

ÆSCHYLUS.—PROMETHEUS VINCTUS, SEPTEM CONTRA THEBAS, AGAMEMNON, PERSÆ, EUMENIDES. By F. A. PALEY, M.A.

EURIPIDES.—ALCESTIS, MEDEA, HIPPOLYTUS, HECUBA, BACCHÆ, ION [price 2s.], ORESTES, PHŒNISSÆ, TROADES, HERCULES FURENS. By F. A. PALEY, M.A.

SOPHOCLES.—ŒDIPUS TYRANNUS, ŒDIPUS COLONEUS, ANTIGONE. By F. A. PALEY, M.A.

HOMER.—ILIAD. Book I. By F. A. PALEY, M.A. 1s.

TERENCE.—ANDRIA, HAUTON TIMORUMENOS, PHORMIO, ADELPHOE. By Prof. WAGNER.

CICERO.—De AMICITIA, De SENECTUTE, EPISTOLÆ SELECTÆ. By the late GEORGE LONG, M.A.

OVID.—Selections from the AMORES, TRISTIA, HEROIDES, and METAMORPHOSES. One Volume. By A. J. MACLEANE, M.A.
[London: WHITTAKER & Co.]

For separate Books of Vergil, Xenophon, and Cæsar, see Grammar School Classics.

CLASS BOOKS.

AUXILIA LATINA. A Series of Progressive Latin Exercises. By M. J. B. BADDELEY, M.A., Second Master at the Grammar School, Sheffield. Part I., Accidence, 2nd Edition, 1s. 6d. Part II., Exercises, 4th Edition, 2s.—Key to Part II., 2s. 6d.

LATIN PRIMER. With Exercises. By Rev. A. C. CLAPIN, M.A., St. John's College, Cambridge; Assistant Master at Sherborne School. Fcap. 8vo, 1s.

LATIN PROSE LESSONS. By ALFRED J. CHURCH, M.A., Professor of Latin at University College, London. Sixth Edition. Fcap. 8vo., 2s. 6d.

LATIN EXERCISES, GRAMMAR PAPERS, and HINTS for JUNIOR CLASSES. By T. COLLINS, M.A., Head Master of the Latin School, Newport, Salop. Fourth Edition. Fcap. 8vo., 2s. 6d.

UNSEEN PAPERS in LATIN PROSE and VERSE, with Examination Questions. By T. COLLINS, M.A. Third Edition. Fcap. 8vo. 2s. 6d.

G. BELL & SONS' EDUCATIONAL BOOKS.

Complete Catalogue of upwards of 500 Educational Books of all kinds, sent post free on application.

CLASS BOOKS.—*Continued.*

UNSEEN PAPERS in GREEK PROSE and VERSE. With Examination Questions. By T. COLLINS, M.A. Fcap. 8vo, 3s.

SCALA LATINA. Elementary Latin Exercises. By the Rev. J. W. DAVIS, Head Master, Tamworth Grammar School. New Edition, with Vocabulary. Fcap. 8vo, 2s. 6d.

SCALA GRÆCA. Elementary Greek Exercises. By the Rev. J. W. DAVIS, M.A., Head Master of Tamworth Grammar School, and the late R. W. BADDELEY, M.A. Third Edition. Fcap. 8vo, cloth, 2s. 6d.

GREEK VERSE COMPOSITION, for Public Schools. By G. PRESTON, M.A., Head Master of King's School, Chester. Fifth Edition. 4s. 6d.

GREEK PARTICLES and their Combinations according to Attic Usage. A Short Treatise. By F. A. PALEY, M.A. 2s. 6d.

ANTHOLOGIA GRÆCA. A Selection of Choice Greek Poetry, with Notes. By Rev. F. ST. JOHN THACKERAY, M.A. Fifth Edition. Neat Cloth, with red edges. 16mo, 4s. 6d.

ANTHOLOGIA LATINA. A Selection of Choice Latin Poetry, from Nævius to Boethius, with Notes. By Rev. F. ST. JOHN THACKERAY, M.A. Fourth Edition. 16mo, 4s. 6d.

By the late Rev. P. FROST, M.A., St. John's College, Cambridge.

ECLOGÆ LATINÆ; or, First Latin Reading Book. With English Notes and a Dictionary. New Edition. Fcap. 8vo. 2s. 6d.

MATERIALS for LATIN PROSE COMPOSITION. New Edition. 2s. 6d.—Key, 4s.

A LATIN VERSE BOOK. An Introductory Work on Hexameters and Pentameters. New Edition. 3s.—Key, 5s.

ANALECTA GRÆCA MINORA. With Introductory Sentences, English Notes, and a Dictionary. New Edition. 3s. 6d.

MATERIALS for GREEK PROSE COMPOSITION. Fourth Edition. 3s. 6d.—Key, 5s.

FLORILEGIUM POETICUM. A Selection of Elegiac Extracts from Ovid and Tibullus. New Edition, greatly enlarged. With English Notes. 3s.

By Rev. H. A. HOLDEN, LL.D, late Head Master of Queen Elizabeth's School, Ipswich.

FOLIORUM SILVULA. Part I. Being Passages for Translation into Latin Elegiac and Heroic Verse. 10th Edition. Post 8vo. 7s. 6d.

FOLIORUM SILVULA. Part II. Passages for Translation into Latin Lyric and Comic Iambic Verse. 3rd Edition. 5s.

FOLIORUM SILVULA. Part III. Passages for Translation into Greek Verse. 3rd Edition. 8s.

FOLIA SILVULÆ, sive Eclogæ Poetarum Anglicorum in Latinum et Græcum conversæ. Vol. II. 12s.

FOLIORUM CENTURIÆ. Selections for Translation into Latin and Greek Prose, chiefly from the University and College Examination Papers. 8th Edition. Post 8vo. 8s.

CAMBRIDGE MATHEMATICAL SERIES.

ALGEBRA. CHOICE and CHANCE. An Elementary Treatise on Permutations and Combinations. With 300 Exercises. By W. A. WHITWORTH, M.A. Third Edition. Revised. 6s.

EUCLID. EXERCISES on EUCLID and in Modern Geometry. By J. McDOWELL, M.A., F.R.A.S. Third Edition. 6s.

TRIGONOMETRY, INTRODUCTION TO PLANE. By Rev. T. G. VYVYAN, M.A. Second Edition. Revised. 3s. 6d.

CONICS, The ELEMENTARY GEOMETRY of. By C. TAYLOR, D.D. Fourth Edition. Revised and Enlarged. 4s. 6d.

CONIC SECTIONS. An Elementary Treatise. By H. G. WILLIS, M.A. 7s. 6d.

SOLID GEOMETRY. An Elementary Treatise on. By W. S. ALDIS, M.A. Third Edition. 6s.

DYNAMICS, An Elementary Treatise on. By W. GARNETT, M.A. Third Edition. 6s.

HEAT, An Elementary Treatise on. By W. GARNETT, M.A. Third Edition. 3s. 6d.

HYDROMECHANICS. By W. H. BESANT, M.A., Sc.D. Fourth Edition. Part I., Hydrostatics. 5s.

MECHANICS, A Collection of Problems in. By W. WALTON, M.A. Second Edition. 6s.

RIGID DYNAMICS. By W. S. ALDIS, M.A. 4s.

Cambridge School & College Text-Books.

A Series of Elementary Treatises adapted for the use of Students in the Universities, Schools, and Candidates for the Public Examinations. Uniformly printed in fcap. 8vo.

ARITHMETIC. By the Rev. C. ELSEE, M.A., late Fellow of St. John's College, Cambridge; Mathematical Master at Rugby. Eleventh Edition. 3s. 6d.

ARITHMETIC. By A. WRIGLEY, M.A. 3s. 6d.

ARITHMETIC. A Progressive Course of EXAMPLES. With Answers. By J. WATSON, M.A., Corpus Christi College, Cambridge. Sixth Edition. 2s. 6d.

ELEMENTARY ALGEBRA. By the Rev. C. ELSEE, Mathematical Master at Rugby. Sixth Edition. 4s.

ALGEBRA. A Progressive Course of EXAMPLES. By the Rev. W. F. MACMICHAEL, late Head Master of the Grammar School, Warwick, and R. PROWDE SMITH, M.A., Master at Cheltenham College. Third Edition. 3s. 6d.—With ANSWERS, 4s. 6d.

AN INTRODUCTION TO PLANE ASTRONOMY. By P. T. MAIN, M.A., Fellow of St. John's College. Fifth Edition. Revised. 4s.

CONIC SECTIONS TREATED GEOMETRICALLY. By W. H. BESANT, M.A., Sc.D., Lecturer and late Fellow of St. John's College. Fifth Edition. 4s. 6d.—SOLUTIONS to Examples, 4s.

ELEMENTARY STATICS. By the Rev. HARVEY GOODWIN, D.D., Bishop of Carlisle. Second Edition. 3s.

ELEMENTARY HYDROSTATICS. By W. H. BESANT, M.A., Sc.D., late Fellow of St. John's College. Eleventh Edition. 4s.

ANALYTICAL GEOMETRY. By T. G. VYVYAN, Fellow of Gonville and Caius College, and Mathematical Master at Charterhouse. Fourth Edition. Revised. 4s. 6d.

AN ELEMENTARY TREATISE ON MENSURATION. By B. T. MOORE, M.A., Fellow of Pembroke College. With numerous Examples. 5s.

THE FIRST THREE SECTIONS OF NEWTON'S PRINCIPIA. With an Appendix, and the Ninth and Eleventh Sections. By JOHN H. EVANS, M.A. Fifth Edition. Edited by P. T. MAIN, M.A. 4s.

GEOMETRICAL OPTICS. With Answers. By W. S. ALDIS, M.A., Trinity College. 3s. 6d.

COMPANION TO THE GREEK TESTAMENT. Designed for Theological Students and the Upper Forms of Schools. By A. C. BARRETT, M.A., Caius College. Fourth Edition. Revised. 5s.

AN HISTORICAL AND EXPLANATORY TREATISE on the BOOK of COMMON PRAYER. By W. G. HUMPHRY, B.D. Sixth Edition. Revised and Enlarged. Fcap. 8vo. 4s. 6d.

TEXT-BOOK OF MUSIC. By H. C. BANISTER, Professor of Harmony at the Royal Academy of Music. Eleventh Edition, with Emendations and new Appendix. Fcap. 8vo. 5s.

HISTORY OF MUSIC. By Rev. H. G. B. HUNT. Sixth Edition. Revised. 3s. 6d.

FORMULÆ, ELEMENTARY MATHEMATICAL. By the Rev. T. W. OPENSHAW, M.A., Second Master at Bristol Grammar School. Fcap. 8vo. 1s. 6d.

SUPPLEMENTARY ARITHMETIC. Improved Methods of Working the more Advanced Rules, with numerous Examples in Proportion, Vulgar Fractions, Percentages, Averaging of Rates, and Scales of Notation; and Examination Papers, with Answers. By Rev. J. HUNTER, M.A. Fcap. 8vo. 2s.

FOREIGN CLASSICS.

Carefully Edited, with English Notes, Grammatical and Explanatory, and Renderings of Difficult Idiomatic Expressions, for use in Schools. Fcap. 8vo.

SCHILLER'S WALLENSTEIN. Complete. Edited by Dr. A. BUCHHEIM, Professor of German in King's College, London. Fifth Edition. 6s. 6d. In two Parts, each 3s. 6d.

SCHILLER'S MAID OF ORLEANS. By Dr. WAGNER. 3s. 6d.

SCHILLER'S MARIA STUART. By V. KASTNER, Professor at Queen's College, Harley Street. 3s.

GOETHE'S HERMANN UND DOROTHEA. Edited by E. BELL, M.A., and E. WOLFEL. 2s. 6d.

GERMAN BALLADS, from Uhland, Goethe, and Schiller. By C. L. BIELEFELD. 3s. 6d.

LAMARTINE'S LE TAILLEUR DE PIERRES DE SAINT-POINT. With Explanatory, Etymological, and Grammatical Notes. By J. BOIELLE, B.A. (Univ. Gall.), Senior French Master at Dulwich College, and Examiner to the Intermediate Education Board, Ireland. Fcap. 8vo. 3s.

CHARLES XII., par Voltaire. By L. DIREY. 3rd Edition. Revised. 3s. 6d.

FENELON'S ADVENTURES DE TELEMAQUE. By C. J. DELILLE. 2nd Edition. 4s. 6d.

SAINTINE'S PICCIOLA. By Dr. DUBUC. 13th Thousand. 1s. 6d.

SELECT FABLES of LA FONTAINE. By F. E. A. GASC. 15th Edition. 3s.

MATERIALS for GERMAN PROSE COMPOSITION. Consisting of Selections from Modern English Writers, with Grammatical Notes, Idiomatic Renderings, and an Introduction. By Dr. BUCHHEIM. 9th Edition. Fcap. 8vo. 4s. 6d.—KEY to Parts I. and II., 3s. Parts III. and IV. 4s.

A GERMAN GRAMMAR for Public Schools. By the Rev. A. C. CLAPIN, and F. HOLL-MULLER, Assistant Master at the Bruton Grammar School. 3rd Edition, revised. Fcap. 2s. 6d.

A GERMAN PRIMER. With Exercises. By the Rev. A. C. CLAPIN, M.A., Examiner in French and German for the Oxford and Cambridge Schools Examination Board, and the Cambridge Local Exams. Fcap. 8vo. 1s.

FRENCH GRAMMAR for Public Schools. By the Rev. A. C. CLAPIN, M.A., Bachelier-ès-Lettres of the University of France. 10th Edition. 2s. 6d.

FRENCH PRIMER. Elementary French Grammar, and Exercises. By the Rev. A. C. CLAPIN, M.A. 6th Edition. Fcap. 8vo. 1s.

PRIMER of FRENCH PHILOLOGY, with Exercises for Public Schools. By Rev. A. C. CLAPIN, M.A. 2nd Edition. 1s.

AN ITALIAN PRIMER. By the Rev. A. C. CLAPIN, M.A., Bachelier-ès-Lettres. Fcap. 8vo. 1s.

The ELEMENTS of the ENGLISH LANGUAGE. By ERNEST ADAMS, Ph.D. 19th Edition. Post 8vo. 4s. 6d.

The RUDIMENTS of ENGLISH GRAMMAR and ANALYSIS. By ERNEST ADAMS, Ph.D. 14th Thousand. Fcap. 8vo. 2s.

QUESTIONS for EXAMINATION in ENGLISH LITERATURE; with a Preface containing brief Hints on the Study of English. Arranged by Prof. SKEAT. 2s. 6d.

W. SWAN SONNENSCHEIN & CO.'S
NEW EDUCATIONAL PUBLICATIONS

Prepared by the Committee appointed by the Association for the Improvement of Geometrical Teaching.

THE ELEMENTS OF PLANE GEOMETRY. (Corresponding to Euclid, Books I. to II.) With numerous Diagrams, crown 8vo, 3s. 6d.

SEEING AND THINKING. Elementary Lessons and Exercises in Grammar, Composition, and Logical Analysis. By Charles Schaible, Ph.D., F.C.P. Second Edition edited by T. F. Althaus, B.A. Crown 8vo, 3s. 6d.

ILLUSTRATED MANUAL OF OBJECT LESSONS. By W. and H. Rooper. With 20 Blackboard Drawings. Crown 8vo, 3s. 6d.

A GERMAN COPY BOOK. By Dr. G. Hein. 16 pages, 4to, in wrapper, 6d.

SELECT POEMS OF GOETHE. Edited by Prof. E. A. Sonnenschein, M.A., Oxon., and Prof. Alois Pogatscher, University of Graz. Fcap. 8vo, limp cloth, 1s.

MUSICIAN, THE: a Guide for Pianoforte Students. By Ridley Prentice. In Six Grades, 2s. each. Grades I. to III., ready.

'Renders the hard task of acquiring a technical knowledge almost a pleasure.....Mr. Prentice's road is in every way the pleasantest that has been laid before any student.....Supplies a deficiency in musical literature which has long been felt.'—*Saturday Review.*

'We heartily commend it to all who desire to understand, interpret, and enjoy beautiful music.'—*Academy.*

SECOND EDITION.

THE CHILD'S PIANOFORTE BOOK. A First Year's Course at the Piano. By H. K. Moore, B.Mus., B.A. Illustrated by Kate Greenaway and others. 4to, cloth gilt, 3s. 6d.

SONGS AND GAMES FOR OUR LITTLE ONES. By J. Mulley. Music by M. E. Tabram. Crown 8vo, 1s., post free.

'A song-book which we warmly recommend to the notice of teachers in Infant Schools and Kinder-gartens.'—*School Guardian.*

Crown 8vo, cloth, 1s. 6d.

NUMBER NOTATION; or Singing made Easy. A Simple System for the Use of Elementary Vocalists. [*This day.*

Rev. EDMUND FOWLE'S SCHOOL BOOKS.

1. **SHORT AND EASY LATIN BOOK.** 1s. 6d.
2. **FIRST EASY LATIN READING BOOK.** 3s. d.
3. **SECOND EASY LATIN READING BOOK.** 3s. d.
4. **SHORT AND EASY GREEK BOOK.** 2s. 6d.
5. **FIRST EASY GREEK READING BOOK.** 5s.
6. **SECOND EASY GREEK READING BOOK.** 5s.
7. **FIRST GREEK READER for Use at ETON.** 1s. 6d.
8. **FIRST BOOK OF HOMER'S ILIAD.** 2s.
9. **SELECTIONS FROM BEST LATIN AUTHORS.** 2s. 6d. In separate parts, Prose and Poetry, 1s. 6d. each.

(In use at Eton, Harrow, Merchant Taylors', etc.)

'Few living classical scholars have done so much, or nearly so much, as Mr. Fowle to smooth the way of the classical scholar by a series of elementary works which, for accuracy in detail and perfection of method, as well as practical utility, are, as a whole, unsurpassed by any similar works in this country. . . . Their tone is scholarly and thorough, and no real difficulty is shirked.'—*School Board Chronicle.*

'It has seldom been our fortune to light upon a Greek Grammar in which economy and retrenchment of space went so thoroughly along with lucidity and solidity of information. . . . A vast amount of thought and pains has been bestowed upon such arrangements of declensions, divisions of a declension, tenses, and tables of verbs, as obviate wearisome repetition and establish a sequence appreciable by the learner.'—*Saturday Review.*

PROBLEMS and EXERCISES in POLITICAL ECONOMY. By Alfred Milnes, M.A., Crown 8vo, cloth, 4s. 6d.

'Not only are the difficulties and problems of economical science admirably stated in this little volume, but the views of the more prominent schools of thought are also indicated. A good deal of labour has been expended upon the work, which economists and publicists will find as valuable as it is unpretentious.'—*Spectator.*

Contains 2,000 Questions derived from Papers set for Cambridge Local C.S., Lond. Univ., Oxford, and other Examinations, with clues as to where the Answers may be found in the Standard Writers.

A LOGICAL ENGLISH GRAMMAR. By G. Fleay, M.A. Foolscap 8vo, 1s. 6d.

AN UNCONVENTIONAL ENGLISH GRAMMAR. By F. A. White, B.A. Foolscap 8vo. Second Edition, 4s.

Part I., Analysis of Words and Pronunciation, just published, 1s., cloth,

THE COMMON-SENSE METHOD OF TEACHING FRENCH. By H. Pooley and K. Carnie.

This method is the outcome of many years' experience, aided by the careful practical study of the systems in use in the Elementary Schools of Paris.

French is a living language, and to be of practical use must be taught conversationally from the outset.

The C.S. Method exercises the pupil in articulation and pronunciation, whilst at the same time he is acquiring, without conscious effort, a large vocabulary of French words, which are brought into daily use. The study of French Grammar is postponed until the pupil can read and understand fluently and intelligently.

Third Edition, now ready, of Sir George W. Cox's (Bart.)

LITTLE CYCLOPÆDIA OF COMMON THINGS. Fully Illustrated, 664 pages, large 8vo, 7s. 6d.

'Has deservedly reached a third edition. For handy reference and information on subjects of common interest it is to be preferred to the big encyclopædias. You get an explanation, for example, concerning the raw materials and products of manufacture, the practical applications of science, and the main facts of natural history, chemistry, and most other departments of knowledge, within brief compass . . . . the numerous illustrations are often a material help in clearing away difficulties and misapprehensions that widely prevail with regard to common things. The volume has also the important recommendation of being remarkably cheap.'—*Scotsman.*

THE ROYAL RELIEF ATLAS OF ALL PARTS OF THE GLOBE. By G. Phillips Bevan, F.G.S. Thirty-one Embossed Maps, each specially framed and guarded. The whole in 1 vol., royal 4to, half-bound, 21s. [*Second Edition.*

SONNENSCHEIN (A.) AND NESBITT (H.A., M.A.) SCIENCE AND ART OF ARITHMETIC. Three Parts in 1 vol., Fifth Edition, 5s. 6d. Part I., Fifth Edition, 2s. 6d. Part II., III., new Stereotyped Edition, 3s. 6d. Exercises to Part I., 1s. Exercises to Part II., III., 1s. 3d. Answers to Exercises complete, 1s. 6d.

SONNENSCHEIN (A.) AND NESBITT (H.A., M.A.) A C OF ARITHMETIC. Teacher's Book, 2 parts, 1s. each. Pupil's Book (Exercises), 2 parts, each 4d.

'The book is good throughout..... Its thoroughness is exceedingly praiseworthy.'—*Spectator.*

ADOPTED BY NUMEROUS SCHOOL BOARDS.

Fifth Edition.

SONNENSCHEIN'S NUMBER PICTURES FOR THE NURSERY, KINDER-GARTEN, AND INFANT-SCHOOL. 14 Coloured Sheets. Folio, mounted on one roller, 7s. 6d.; on boards, varnished, 16s. Descriptive pamphlet, 6d.

Extract from the General Report by Her Majesty's Inspector, the Rev. J. Rice Byrne, to the Lords of the Education Department, on the Schools inspected by him in the county of Surrey:—'The progress made in arithmetic is out of proportion small in comparison with the extraordinary labour bestowed upon it, a result which I attribute less to the intrinsic difficulty of the subject than to the manner of teaching it. .....It is for this reason that I venture to commend to your Lordships' notice the system of "NUMBER PICTURES," which has for its object to make arithmetic *intuitive*, exhibiting its principles by means of representations of concrete magnitude.....It has received high commendations from eminent authorities.'

SONNENSCHEIN'S LINEAR BLACKBOARD MAPS (Outline Wall Maps with Blackboard Surface, rolling up).

☞ Adopted by London and other School Boards.

First Map—**England and Wales**, 4 ft. 9 in. by 4 ft., 16s.
Second Map—**Europe**, 5 ft. 6 in. by 4 ft. 6 in., 21s. Third Map—**Two Hemispheres** *(in preparation)*. Fourth Map—**Africa.**

FOR LOND. INTERMEDIATE EXAM.

Interleaved, crown 8vo, 2s. 6d.

THE HIERO OF XENOPHON. Edited with Introduction and Notes, by R. Shindler, M.A.

'Is well fitted for a school book . . . . of convenient length, and the Greek is of that Attic clearness and purity which we find in Xenophon.'—*Athenæum.*

FOR ARMY CANDIDATES.

THE STUDENT'S HISTORY OF THE REIGN of GEORGE III. Based on Bright, Macaulay's Essays, Napier, etc. By Oxon (an Army Tutor). 4s. 6d.

THE CAMBRIDGE EXAMINER. A Series of Papers set by Ladies Holding Univ. Cert., who are engaged in preparing Pupils for the Cambridge Examinations. Monthly, 6d.